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FEASIBILITY STUDY OF IN-CABIN STORAGE OF WHEELCHAIRS AND SCOOTERS ON COMMERCIAL AIRCRAFT

Prepared for the
Transportation Development Centre

Transport Canada

by

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W.R. Davis Engineering Limited

March 1988

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Un sommaire en français de ce document est inclus avant la table des matières.

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17. Abstract

This report examines the feasibility of in-cabin storage of manual wheelchairs and electric scooters on commercial aircraft.

The study focused on dimensional constraints and operational considerations identified by carriers. Other topics included: consumer demand and the design of a conceptual securement method.

Based on an evaluation of dimensional considerations, the study concludes that a carry-on baggage unit can store one manual, collapsible wheelchair. Minor modifications are identified to provide a more efficient utilization of the space available. In-cabin storage of an electric scooter is deemed not feasible owing to size, weight and time limitations and battery packaging requirements.

Basic design guidelines for a securement device are outlined and the development and in-service evaluation of a prototype storage location is recommended.

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17. Résume

Ce rapport résume une étude sur la possibilité de ranger en cabine des fauteuils roulants manuels, et de type scooter, à bord des avions commerciaux.

Les chercheurs ont tenu compte surtout des contraintes d'espace et d'exploitation définies par diverses compagnies de transport aérien, mais aussi des besoins définis par les utilisateurs. Ils ont aussi étudié une méthode d'assujettissement des fauteuils.

Après avoir étudié les contraintes espace/encombrement, on a conclu qu'un module de rangement pouvait contenir un fauteuil manuel pliant. Il suffirait de légères modifications pour optimiser l'utilisation de l'espace disponible. Par contre, il n'est pas possible de ranger en cabine des fauteuils de type scooter en raison de leur encombrement, de leur poids, du temps qu'il faut pour les démonter et les remonter et des exigences concernant le transport des accumulateurs.

Le rapport trace enfin les grandes lignes de l'étude d'un dispositif d'assujettissement des fauteuils et fait des recommandations quant à l'aménagement et à l'évaluation en service d'un espace spécial de rangement.

18. Mots-clés	19. Diffusion
Avion, rangement, fauteuil roulant manuel, fauteuil roulant de type scooter, handicapés physiques.	Le Centre de développement des transports dispose d'un nombre limité d'exemplaires.

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SUMMARY

This study was conducted by W.R. Davis Engineering Limited for the Transportation Development Centre to evaluate the feasibility of providing in-cabin storage for manual wheelchairs and electric scooters in commercial aircraft. The study was limited in scope to:

- Identification of the type of disabled traveller who would benefit most from this service.
- Dimensional review of common mobility aids.
- Dimensional review of the floor plans of some aircraft.
- Identification of the constraints affecting the concept.
- Development of securement methods.

Approximately 0.3% of the 21 million air passengers travelling in Canada each year own a wheelchair. An evaluation of the disabled traveller classifications indicates that in-cabin storage service would be most beneficial to self-reliant wheelchair users who can travel within the terminal under their own power.

This study addresses a number of issues identified in "Air Transportation of Disabled Persons in Canada; An Assessment of its Current State" by Linda Legault (Concordia University, 1986):

- The use of personal wheelchairs to board the aircraft

  In-cabin storage will not eliminate the requirement for passengers to transfer from their personal wheelchairs to aisle wheelchairs. The width of the aircraft aisle and the width of the conventional wheelchair preclude, in most cases, the personal wheelchair being moved to the passenger's seat.

- The use of on-board wheelchairs

  For the same reasons, in-cabin storage will not eliminate the need for the on-board wheelchair to facilitate the movement of disabled passengers.

- Safe storage of mobility aids

  There is less risk of damage to mobility aids if they can be stored in the aircraft cabin rather than the cargo hold.

- Carriage of wet cell batteries

  The International Air Transportation Association requires that wet cell batteries be packaged and transported in the hold. As a result the benefits to the passenger of having the scooter in the cabin are minimized. The storage of batteries inside the aircraft cabin has not been addressed.

- Immediate replacement of lost or damaged items

  The storage of a wheelchair in a specifically designed area within the cabin would result in minimal loss of, or damage to, wheelchairs.

Wheelchair, aircraft and carrier constraints were reviewed to determine whether the in-cabin storage concept is feasible. The constraints include wheelchair size, required and available storage space, safety and accessibility of the storage unit, and the cabin modifications required to meet safety and technical requirements.

Potential storage locations were selected by reviewing floor plans of various aircraft and conducting on-site trials of three common aircraft (DC-9, B-727, B-767). Three areas were identified as potential storage locations, on the basis of their dimensions only:

- carry-on baggage (C.O.B.) units
- bulkhead mounting
- existing cabinets

Field trials indicated that the most feasible area is the C.O.B. unit. Minor modifications would be required to facilitate storage of a collapsible manual wheelchair in the C.O.B. units. They consist of the reconfiguration of the lower shelf to permit fore to aft folding as opposed to left to right folding (with respect to the aircraft), the addition of securement hardware and attachment points. Bulkhead mounting was not considered further due to safety considerations. Although a wheelchair would fit in some existing cabinets, the spaces have been allocated for carrier equipment and are therefore not available.

With regard to securing the mobility aid, the study concludes that, without the assignment of a dedicated storage area on all aircraft, no securement system applicable to all aircraft can be designed. However, storage of one collapsible manual wheelchair on some aircraft, such as a B-727 or DC-9, is possible on a technical and dimensional basis. That is to say, a storage area is available and this area can be modified such that it will meet the load bearing requirements defined by the airworthiness standards. Carrier considerations such as space allocation, the time required to store the wheelchair and the question of who will store the wheelchair must still be addressed.

Storage of electric scooters is not feasible, owing to a number of dimensional and operational problems:

- the time required to dismantle the scooter,
- the packaging and storage requirements of the batteries,
- the space required to maneuver the assembled scooter within the aircraft,
- the weight of the components,
- the volume of the scooter, even in the disassembled state.

In order to further evaluate the concept of in-cabin storage of manual wheelchairs, the study outlines a three-phase in-service evaluation program and provides budgetary estimates of the costs:

Phase I	Detailed Design/Cost Evaluation
Phase II	Prototype Fabrication
Phase III	Compliance Program Preparation/Field Trials

The study recommends a phased trial program to fully evaluate the ramifications of this service.

SOMMAIRE

La présente étude consistant à examiner la possibilité de ranger en cabine les fauteuils roulants, manuels ou de type scooter, à bord des avions commerciaux, a été menée par la firme W.R. Davis Engineering Limited pour le Centre de développement des transports. Elle s'est déroulée selon la démarche suivante :

- détermination de la catégorie de passagers handicapés à qui ce service serait le plus utile;
- étude des dimensions des aides à la motricité les plus courants;
- étude des plans cotés de divers appareils;
- définition des contraintes s'appliquant au projet envisagé;
- étude de modes d'assujettissement appropriés.

Environ 0,3 p.100 des 21 millions de passagers transportés par avion au Canada chaque année se déplacent en fauteuil roulant. Une étude sur les catégories de passagers handicapés a révélé que le rangement en cabine des fauteuils roulants serait surtout utile aux handicapés autonomes capables de se déplacer par leurs propres moyens dans l'aérogare.

Cette étude reprend plusieurs points soulevés par Linda Legault, de l'Université Concordia, dans un rapport rédigé en 1986 et intitulé: "Air Transportation of Disabled Persons in Canada: an Assessment of its Current State".

- Embarquement des passagers avec fauteuil roulant

  Le rangement en cabine des fauteuils des passagers handicapés n'élimine pas la nécessité de transférer ceux-ci de leur propre fauteuil à un fauteuil de bord pour les amener jusqu'à leur siège puisque, dans la plupart des cas, les allées ne sont pas assez larges pour permettre le passage d'un fauteuil roulant ordinaire.

- Utilisation de fauteuils roulants de bord

  Pour les mêmes raisons, le rangement en cabine des fauteuils roulants des passagers handicapés n'élimine pas la nécessité de prévoir des fauteuils roulants spécialement dimensionnés à bord des avions.

- Risques d'endommagement

  Les fauteuils roulants risquent moins d'être endommagés s'ils sont rangés en cabine plutôt que dans la soute à bagages.

- Transport d'accumulateurs à électrolyte liquide

  L'Association du transport aérien international exige que ce type d'accumulateur soit emballé conformément à des prescriptions bien précises et transporté dans la soute à bagages. Le rangement en cabine de fauteuils roulants de type scooter n'est dès lors plus d'une grande utilité. Le transport en cabine des accumulateurs n'a pas été considéré.

- Remplacement immédiat des fauteuils égarés ou endommagés

  Le rangement des fauteuils roulants dans un endroit spécialement prévu de la cabine éliminerait, à toutes fins utiles, le risque de perte ou d'endommagement.

Pour déterminer si le rangement en cabine des fauteuils roulants était possible, les chercheurs ont analysé les contraintes imposées par les caractéristiques des fauteuils et celles des avions, ainsi que par les exigences des transporteurs. Ils ont donc considéré l'encombrement des fauteuils, l'espace de rangement requis et l'espace disponible, la sécurité et l'accessibilité des modules de rangement, ainsi que les modifications à apporter à la cabine pour répondre aux normes de sécurité.

Les plans cotés de divers appareils ont été examinés et des essais de rangement effectués dans trois modèles courants d'appareils (DC-9, B-727 et B-767) afin de déterminer les places de rangement possibles. Trois possibilités ont été retenues en tenant compte uniquement des contraintes dimensionnelles, soit :

- le module de rangement des bagages à main;
- l'assujettissement sur cloison;
- le rangement dans une armoire de l'appareil.

Les essais ont révélé que l'endroit le plus propice serait le module de rangement, sous réserve de légères modifications. Il suffirait de modifier l'étagère inférieure de sorte qu'au lieu de se replier dans l'axe longitudinal de l'appareil, elle se replie dans l'axe transversal et vers l'arrière, puis de poser le dispositif d'assujettissement sur la paroi avant du module. L'assujettissement sur cloison a été écarté d'emblée pour des raisons de sécurité. Quant aux armoires de l'appareil, même si un fauteuil plié peut y entrer, tout l'espace est déjà utilisé pour le rangement de l'équipement de bord.

Pour ce qui est de l'assujettissement des fauteuils, on a conclu qu'à moins d'un espace de rangement pour fauteuils roulants spécialement prévu dans chaque type d'appareil, il est impossible d'étudier un dispositif d'assujettissement commun à tous les appareils. Toutefois, on peut envisager le rangement en cabine d'un fauteuil manuel pliant à bord de certains appareils comme le B-727 et le DC-9, qui comportent l'espace requis et se prêtent aux modifications nécessaires sans que ne soit compromise la conformité aux exigences de capacité portante définies par les normes de navigabilité. Les questions intéressant l'exploitation, c'est-à-dire l'endroit où ranger les fauteuils roulants, qui serait chargé de le faire, et le temps requis, etc., n'ont pas encore été prises en considération.

Le rangement en cabine de fauteuils du type scooter a été jugé impossible pour diverses raisons ayant trait aussi bien aux contraintes physiques qu'aux contraintes d'exploitation :

- le temps requis pour démonter et remonter ce type de fauteuil;
- les exigences relatives au transport des accumulateurs;
- l'espace nécessaire pour manoeuvrer le fauteuil à bord de l'avion;
- le poids des éléments constitutifs du fauteuil;
- l'encombrement du fauteuil, même démonté.

L'étude propose enfin un programme d'évaluation en service du concept de rangement en cabine des fauteuils roulants manuels. Ce programme comporte trois étapes et les auteurs fournissent pour chacune une ventilation approximative des coûts.

Étape I : Étude détaillée et estimation des coûts
Étape II : Construction d'un prototype
Étape III : Élaboration d'un programme de re-certification des appareils rééquipés/mise en service expérimental

On recommande un programme de mise en exploitation expérimentale par étapes, permettant d'évaluer toutes les répercussions du service envisagé.

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GLOSSARY OF TERMS

In-Cabin Wheelchair Storage	-	The storage of a passenger's personal wheelchair inside the cabin of an aircraft.
On-Board Wheelchair	-	An airline owned, collapsible wheelchair designed to fit down the aisle of, and be permanently stored in, an aircraft. Its purpose is to provide a mobility impaired passenger with a means of mobility within the aircraft cabin.
Airport Wheelchair	-	An airline owned wheelchair available for use within the terminal and/or the aircraft while it is at the airport. These wheelchairs are used when passengers are boarding and deplaning, but do not leave the airport. This category is further subdivided: Airport Terminal Wheelchair - Used only within the airport terminal. This wheelchair cannot be used in an aircraft due to the width. Airport Aisle Wheelchair - This wheelchair will fit within the confines of an aircraft.
Boarding Wheelchair	-	An airport terminal based wheelchair that is used to assist mobility impaired passengers to their seats when aircraft boarding stairs must be used. Can also be used as an Airport Aisle Wheelchair.
Personal Wheelchair	-	The wheelchair that the passenger brings to the airport.
Stopover	-	A period of time when an aircraft is docked at an airport en route to a final destination.
Connection	-	A situation where a passenger must deplane and board another aircraft to continue to the final destination.

1. INTRODUCTION

1.1 Background

In recent years, making public transportation facilities and associated services more readily accessible to handicapped persons has been a concern shared by both government and industry. In general, solutions to specific user related problems fall into two categories, planning for new equipment purchases, or retrofitting existing facilities. In the case of air travel, a need to improve the handling of handicapped persons, in particular mobility impaired individuals, was identified.

This report was written under contract to the Transportation Development Centre to review and evaluate the feasibility of storing manual wheelchairs and electric scooters in the cabins of commercial aircraft.

The study was driven by the belief that mobility impaired air travellers could better be served by providing storage for wheelchairs and scooters inside the cabin of aircraft. Among the primary desires of the handicapped traveller was the development of wheelchair handling methods which would:

- minimize the need to transfer passengers to uncomfortable airport wheelchairs,
- eliminate cargo hold damage to personal equipment, and the associated damage claims,
- increase access to personal wheelchairs during stopovers, connections and flight delays.

The option to remain in one's own chair as far as the boarding device, and to have the unit stowed on board in the cabin for ready use upon deplaning, was perceived as a potential improvement over the present systems.

1.2 Objective

The objective of this study was to evaluate the feasibility of in-cabin storage of collapsible manual wheelchairs and electric scooters. This study did not explore methods of providing on-board mobility for handicapped persons.

Further to this end, several sub-tasks were conducted:

- The type of handicapped traveller which would benefit most from this service was identified.

- Current boarding methods were reviewed.

- Floor plans of some common commercial aircraft were reviewed.

- The constraints affecting the concept were reviewed and evaluated.

- Conceptual wheelchair/scooter securement locations were identified for possible in-service evaluation.

1.3 Scope of Work

Recognizing the wide variety of aircraft types and cabin layouts used in Canada, and the budgetary limitations on this study, an exhaustive dimensional review of all commercial aircraft was beyond the scope of this report.

2. CONSUMER DEMAND

To determine the feasibility of an in-cabin storage system, it is necessary to estimate the utilization rate and identify the passengers who will be affected by the concept. An order of magnitude estimate of the utilization rate can be arrived at by examining data on both disabled persons and the volume of air traffic in Canada.

2.1 Statistics

Air travel in Canada, and around the world, is becoming increasingly popular as a means of transportation. In her report,"Air Transportation of Disabled Persons in Canada: An Assessment of its Current State"[1], Linda Legault stated:

> "Statistics showed that in 1982 more than 24 million passengers in Canada travelled by air and predictions state an increase of this number is expected annually. Estimates are that by the year 2021, the 65 and over age group will comprise between 14% and 17% of the Canadian population"(1).

These statistics do not imply that everyone over the age of 65 is mobility impaired but the incidence of transportation disabilities does increase with age as shown in Figure 2.1.

A survey conducted in 1983(2) sampled approximately 39,000 individuals who were 15 years of age and over from ten provinces in Canada. The survey excluded some segments of the national population, who totalled about 2% of the total. Based on a target population of 18,848,000 people, 533,000 (2.8%) people have some physical condition or health problem which made travel difficult without some form of assistance or aid.

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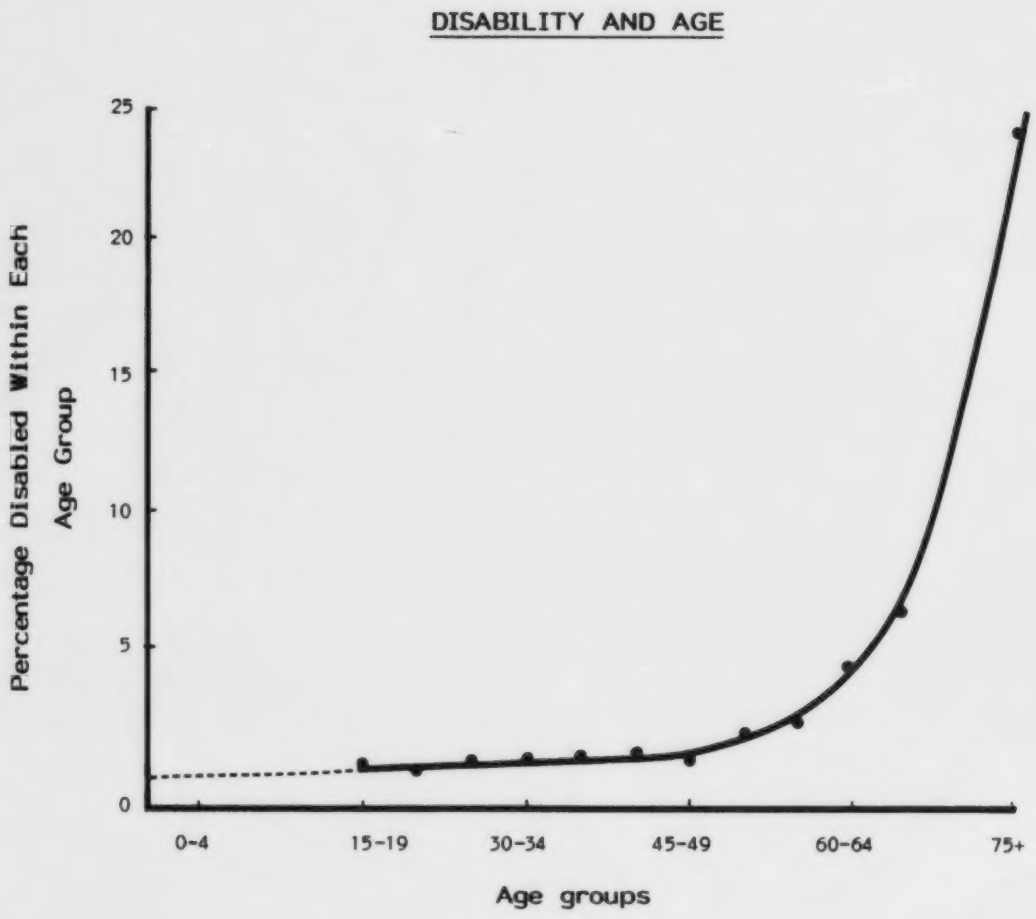
(1) Linda Legault, Air Transportation of Disabled Persons in Canada: An Assessment of its Current State", Concordia University, Montreal, 1986, pg. 1.

(2) Mara Lee McLaren and Marion S. Fleming, Special Needs in Transportation; Some Survey Results, (Canadian Transport Commission, Ottawa, 1984), pg. 6.



TAKEN FROM: McLaren, Mara Lee, and Fleming, Marion S.
Special Needs in Transportation: Some Survey Results
Ottawa: Canadian Transport Commission, 1985.

Figure 2.1 Disability and Age

Of the 533,000 people who are disabled, 71.1% have stated that they have a mobility related problem. In addition, 39% of the disabled people, who indicated that they had difficulty travelling without an assistant, stated that they were prevented from using aircraft.

Mobility impaired passengers encountered difficulties with the following situations[3]:

- Stairs 72%
- Boarding 63%
- Seating 18%
- Moving about Terminals 58%
- Washrooms 25%

The values reflect the number of people who indicated that a particular difficulty was encountered, as a percentage of the total number of mobility impaired air travellers.

Mobility impaired people need various forms of assistance to help make travelling easier. From the 1983 survey, the following forms of assistance were highlighted:[4]

- Wheelchair Owned 16%
- Wheelchair Provided 32%
- Special Assistance 48%
- Personal Attendant 46%
- Walking Aids 45%

It is apparent that in 1983, approximately 60,600 mobility impaired people (i.e. 16% of 71% of 533,000) owned a wheelchair.

Statistics for 1983 indicate that the top 50 airports handled 97.9% of the total passengers in Canada (Table 2.1). This percentage accounts for 42,057,863 total trips, including boarding and deplaning. To obtain the total number of passengers, this figure should be divided by two, for a total of approximately 21,000,000.

If the assumption is made that wheelchair owners use their wheelchairs when travelling, and that they travel as often as non mobility impaired individuals, then based on the number of 60,600, approximately 0.3% of the air travellers in 1983 could make use of "in-cabin" storage. This assumption sets an "Upper Limit" on the estimate. Factors such as specific type of disability and geographic distribution of individuals may affect the actual percentage.

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(3) McLaren and Fleming, pg. 14

(4) McLaren and Fleming, pg. 15

Table 2.1 Air Traffic Statistics 1983

APPENDIX H: AIRPORTS RANKED BY TOTAL ENPLANED PLUS DEPLANED PASSENGERS FOR THE YEAR 1983*

RANK	AIRPORT	PASSENGERS (NUMBER)	% OF TOTAL	CUMULATIVE PASSENGER (NUMBER)	% OF TOTAL
1	TORONTO INTERNATIONAL	12 008 232	27.9	12 008 323	27.9
2	VANCOUVER INTERNATIONAL	5 791 983	13.5	17 800 306	41.4
3	MONTREAL INTERNATIONAL	5 123 269	11.9	22 923 575	53.3
4	CALGARY INTERNATIONAL	3 533 476	8.2	26 457 051	61.6
5	WINNIPEG INTERNATIONAL	1 971 234	4.6	28 428 285	66.2
6	EDMONTON INTERNATIONAL	1 812 214	4.2	30 240 499	70.4
7	OTTAWA INTERNATIONAL	1 794 735	4.2	32 035 234	74.5
8	HALIFAX INTERNATIONAL	1 395 878	3.2	33 431 112	77.8
9	MIRABEL INTERNATIONAL	1 112 128	2.6	34 543 240	80.4
10	EDMONTON MUNICIPAL	731 395	1.7	35 274 635	82.1
11	REGINA SASK	553 374	1.3	35 828 009	83.4
12	SASKATOON SASK	524 940	1.2	36 352 949	84.6
13	ST JOHNS NFLD	463 122	1.1	36 816 071	85.7
14	QUEBEC PQ	459 534	1.1	37 275 605	86.7
15	VICTORIA INTERNATIONAL	444 269	1.0	37 719 874	87.8
16	THUNDER BAY ONT	346 068	.8	38 065 942	88.6
17	KELOWNA BC	322 877	.8	38 388 819	89.3
18	PRINCE GEORGE BC	220 823	.5	38 609 642	89.8
19	MONCTON NB	206 313	.5	38 815 955	90.3
20	WINDSOR ONT	172 103	.4	38 988 058	90.7
21	SAINT JOHN NB	167 342	.4	39 155 400	91.1
22	FREDERICTON NB	163 286	.4	39 318 686	91.5
23	KAMLOOPS BC	148 558	.3	39 467 244	91.8
24	SAULT STE MARIE ONT	148 112	.3	39 615 356	92.2
25	FORT ST JOHN BC	143 992	.3	39 759 348	92.5
26	SYDNEY NS	140 944	.3	39 900 292	92.8
27	CHARLOTTETOWN PEI	140 402	.3	40 040 694	93.2
28	SEPT ILES PQ	136 146	.3	40 176 840	93.5
29	SUDBURY ONT	135 229	.3	40 312 069	93.8
30	VAL D OR PQ	127 513	.3	40 439 582	94.1
31	GANDER INTERNATIONAL	126 778	.3	40 566 360	94.4
32	PRINCE RUPERT BC	109 457	.3	40 675 817	94.7
33	CRANBROOK BC	99 546	.2	40 775 363	94.9
34	TIMMINS ONT	97 155	.2	40 872 518	95.1
35	FORT MCMURRAY ALTA	96 379	.2	40 968 897	95.3
36	DEER LAKE NFLD	91 423	.2	41 060 320	95.5
37	YELLOWKNIFE NWT	90 819	.2	41 151 139	95.8
38	WHITEHORSE YT	88 653	.2	41 239 792	96.0
39	TERRACE BC	81 771	.2	41 321 563	96.2
40	PENTICTON BC	80 954	.2	41 402 517	96.3
41	DAWSON CREEK BC	74 359	.2	41 476 876	96.5
42	BAGOTVILLE PQ	71 458	.2	41 548 334	96.7
43	ROUYN PQ	70 366	.2	41 618 700	96.8
44	WABUSH NFLD	69 430	.2	41 688 130	97.0
45	THOMPSON MAN	65 354	.2	41 753 484	97.2
46	BAIE COMEAU PQ	64 304	.1	41 817 788	97.3
47	CASTLEGAR BC	62 819	.1	41 880 607	97.5
48	MONT JOLI PQ	62 628	.1	41 943 235	97.6
49	COMOX BC	57 870	.1	42 001 105	97.7
50	NORTH BAY ONT	56 758	.1	42 057 863	97.9
OTHERS		916 624	2.1	42 974 487	100.0

*STATISTICS CANADA 51-203, TABLE 3 (9)
Figures are for all Class 8 scheduled international flights flow into and out c Canada by Canadian and foreign airlines as well as all Class 1 and 2 domestic commercial flights.

If statistics from the top 10 international airports are investigated, the total number of wheelchair owner departures on a yearly basis, may reach 18,000 at Toronto International Airport and 1,100 at Edmonton Municipal Airport.

2.2 Classification for Air Transport

Disabled passengers using air transportation are classified according to severity of disability and degree of self-reliance. The following section defines the accepted terminology used for the transportation of disabled passengers.[5]

- **AMBULATORY**[6] - A passenger who is able to move about within the aircraft cabin unassisted. This includes the blind, deaf, mentally retarded.

- **NON-AMBULATORY** - A passenger who is not able to move about within the aircraft cabin unassisted.

- **SELF-RELIANT** - The handicapped passenger is independent, self-sufficient and capable of taking care of all of his physical needs in flight. The passenger requires no special or unusual attention beyond that afforded to the general public, except that he may require assistance in boarding and deplaning.

- **NON-SELF-RELIANT** - The handicapped passenger is incapable of self-care during the flight; he/she depends upon another person to look after his/her physical needs. Thus the non-self-reliant handicapped person requires a personal attendant.

  Airlines will normally accept the handicapped passengers determination of whether he/she is self-reliant or not.

- **PERSONAL ATTENDANT** - Any able-bodied adult having use of all limbs and eyesight, who is physically capable of assisting the handicapped person to an exist in the event of an emergency and attending to the personal needs of the handicapped during flight.

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(5) Ed Ratushny, AIR ACCESSIBILITY STANDARDS FOR DISABLED AND ELDERLY PERSONS, Transport Canada, 1984, p. A48.

(6) Ratushny, Pg. A52-A55.

- **WCHP-WHEELCHAIR-P FOR PARAPLEGIC** - Paraplegic self-reliant wheelchair passenger.

  These passengers are completely immobile but self-reliant. A wheelchair is required to/from the aircraft/mobile lounge and assistance must be provided for going up or down steps, to/from the cabin seat, etc. This category of wheelchair passenger is rehabilitated, self-reliant and capable of taking care of all physical needs in flight. Precautions must be taken to avoid the necessity of using the aircraft washrooms and also to avoid the requirement of special or unusual attention (except boarding and deplaning assistance) beyond that afforded the general public. The passenger may travel without a personal attendant.

- **WCHC-WHEELCHAIR-C FOR CABIN SEAT** - Paraplegic/quadraplegic, non-self-reliant, wheelchair passenger.

  These passengers are completely immobile and require a wheelchair to/from the aircraft/mobile lounge. Assistance must be provided in order that they must be carried up/down steps and to/from their cabin seat.

  This category of wheelchair passenger differs from the WCHP (see above) in that these passengers suffer an additional physical/mental disability and are incapable of self-care during the flight. Passengers in this category must be accompanied by a personal attendant. They are not self-reliant.

- **WCHS-WHEELCHAIR-S FOR STEPS** - Self-reliant wheelchair passenger.

  These passengers cannot ascend/descent steps but are able to make their own way to/from the cabin seat. A wheelchair is required in order for transport to/from the aircraft or lounge. The passenger also must be carried up/down steps.

  Wheelchair passengers in this category are self-reliant and are able to walk within the aircraft.

- **WCHR-WHEELCHAIR-R FOR RAMP** - Self-reliant wheelchair passenger.

  These passengers can ascent/descend steps and make own their way to/from the cabin seat but require a wheelchair for the distance to/from the aircraft, i.e., across ramp or to departure lounge is applicable.

The passengers in this category are self-reliant and are able to walk within the aircraft.

For the purposes of this study, mobility impaired passengers falling into the following categories are considered:

- Non-ambulatory, Self-Reliant
- Non-ambulatory, Non-Self-Reliant.

This group of air travellers will, for the most part, bring a personal wheelchair with them as part of their normal baggage.

3. PASSENGER PERCEIVED NEEDS

Together with the need for safe and dignified entry and exit to and from aircraft, mobility impaired passengers have identified the need for:

- Curb to curb assistance,
- Assistance with baggage,
- Moveable armrests to facilitate transfer into seats,
- Accessible washrooms on board the aircraft,
- "Grab" or support bars within the washroom,
- *- The use of personal wheelchairs to board aircraft,
- *- On-board wheelchairs,
- *- Safe storage of mobility aids in the cargo hold,
- *- Carriage of "wet cell" batteries used for electric wheelchairs or scooters,
- *- Immediate replacement for lost or damaged items,
- *- Storage space for personal wheelchairs and aids on all aircraft (7).

User requirements are continually changing as more mobility impaired individuals travel by air; however, in response to these requests, air carriers have implemented programs/systems/procedures in order to accommodate mobility impaired passengers. At present, many of these needs have been met and the solutions offered by the air carriers.

The provision of in-cabin storage space for manual wheelchairs and electric scooters has an effect, either directly or indirectly, on most of these needs (identified by an asterisk (*)). The following section examines specifically these needs, and how current methods and policies associated with them will be affected by providing in-cabin storage.

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(7) Legault, pg. 35

3.1 The Use of Personal Wheelchairs to Board Aircraft

In almost all cases, handicapped individuals regard their wheelchair as their legs, and therefore this item is important to them. The wheelchair is prescribed to fulfill the specific needs of each individual with regards to size, options, and style. It must be remembered that for some handicapped persons, specific measurements must be taken by an occupational therapist to determine critical dimensions such as torso size, elbow height, and leg length in order to properly size the wheelchair.

The airlines are cognizant of the desire for handicapped travellers to retain their chairs, and in most cases, they comply by following procedures designed to keep the wheelchair with the passenger for as long as possible. Several procedures are used to actually move the passenger from the check-in counter to the aircraft seat. Which one is employed depends upon the carrier and the airport. A number of common methods are outlined in the following section, and are subdivided to discuss boarding methods at airports with and without loading bridges.

3.1.1 Airports Equipped with Loading Bridges

3.1.1.1 Method A-1 - Relinquishes Personal Wheelchair

3.1.1.1.1 Boarding

(a) The Passenger arrives at the check-in counter.

(b) The Passenger transfers from the personal wheelchair to an airport terminal wheelchair provided by the airline.

(c) The Passenger checks the luggage and the personal wheelchair as cargo hold luggage.

(d) The Passenger is assisted, as required, by an airline employee from the check-in counter to the departure gate. Depending on the type of wheelchair and the degree of disability, the passenger may choose to travel through the airport under his own power.

(e) The Passenger waits with the airline employee for the preboarding call at the departure gate.

(f) The Passenger is assisted by the employee, when the preboarding call is announced, into the airport aisle wheelchair.

(g) The Passenger is assisted into the aircraft and then into the aircraft seat.

(h) The airport aisle wheelchair is removed from the aircraft.

3.1.1.1.2 Deplaning

(a) Attendants at the destination airport are informed that a Passenger requiring a wheelchair is on the arriving flight.

(b) An attendant meets the aircraft at the gate with an airport aisle wheelchair.

(c) After the other passengers have deplaned the attendant takes the wheelchair into the aircraft and the mobility impaired Passenger who transfers to the airport aisle wheelchair.

(d) The airline employee assists the Passenger as necessary to the baggage claim. If the passenger desires he may be transferred to an airport terminal chair so that he may travel within the terminal under his own power. Stops at customs and immigration counters are made as necessary.

(e) The Passenger (and the airline employee) retrieve the personal wheelchair.

(f) The Passenger is assisted from the airport wheelchair to the personal wheelchair.

3.1.1.2 Method A-2 - Retains Personal Wheelchair

Policy dictates that the passenger should be able to remain with his wheelchair for as long as possible. This is preferable from both the passenger's and the carrier's point of view. In some cases the passenger can stay with his wheelchair until he transfers to the aircraft seat, however; this is not always possible due to aisle width and turning radius limitations (Section 4.0).

3.1.1.2.1 Boarding

(a) The Passenger arrives at the check-in counter.

(b) The personal wheelchair is tagged as checked baggage; however, the Passenger remains in the wheelchair.

(c) An airline employee assists the Passenger as required from the check-in counter to the departure gate, however; at the Passenger's option he may choose to travel through the airport under his own power.

(d) At the departure gate the Passenger and an airline employee wait for the preboarding call.

(e) When the preboarding announcement is made the airline employee assists the Passenger into the aircraft to his seat, if the type of aircraft and the seat location make this possible. If seat access is not possible the Passenger will transfer to an airport aisle wheelchair.

(f) The Passenger is assisted to a seat on the aircraft.

(g) The Passenger's wheelchair is delivered to the aircraft baggage hold via an exit from the loading bridge to the tarmac.

3.1.1.2.2 Deplaning

The procedure is reversed when the Passenger is deplaning. The personal wheelchair is usually the last piece of luggage to be loaded so that it can be easily retrieved for Passenger deplaning at his destination.

3.1.2 Airports without Loading Bridges

If the airport terminal is not equipped with a loading bridge, which allows the passenger to be wheeled directly to the door of the aircraft, alternative methods are employed by the carrier for moving disabled passengers to the aircraft.

3.1.2.1 Method B-1 - Boarding Wheelchair

(a) The Passenger is assisted into a Boarding Wheelchair at or near the aircraft.

(b) The Passenger and the chair are then lifted on board the aircraft by airline employees, and wheeled to the Passenger's seat.

(c) The Passenger is then assisted from the Boarding Wheelchair into the aircraft seat.

(d) The Passenger's personal wheelchair is then stored in the cargo hold of the aircraft.

3.1.2.2 Method B-2 - Galley Truck

The galley truck is normally used to transport galley carts or cabin cleaning equipment to and from the aircraft. Most of the galley trucks are similar in design consisting of a chassis with a scissor lift van

body. The major difference between the galley truck models is the overall size of the storage area and the maximum elevation of the lift.

When used to assist boarding, wheelchair passengers are lifted into the truck by means of a hydraulic tail lift. If there is no tail lift, the passenger is lifted by airline employees. The truck is then driven to the aircraft and the platform elevated to the aircraft door. The passenger is wheeled into the aircraft and assisted into their seat. The wheelchair, in which the passenger is seated, will vary depending on the airport and the equipment available. It is probable that the passenger will be transferred to an airport aisle wheelchair or a boarding wheelchair to facilitate access to the aircraft prior to being lifted into the galley truck.

3.1.2.3 Method B-3 - Forklift and Pallet

As of September 1985, at airports not equipped with loading bridges, the most common equipment used to board mobility impaired passengers was a forklift and pallet.

The forklift and pallet used by the major carriers in Canada is basic in design. The pallets are specially designed to accommodate a wheelchair passenger and attendant. Typical units are rectangular measuring 1.9 m long by 1.2 m wide and 0.76 m high (6.2 ft long by 3.9 ft wide by 2.5 ft high) walls. The pallet, on the lift truck forks, is elevated to the door where the passenger is assisted into the aircraft[8]. As with the galley truck it is probable that the passenger will be transferred to an airport aisle wheelchair or a boarding wheelchair to facilitate access to the aircraft prior to being lifted onto the pallet.

3.1.2.4 Method B-4 - Plane-Mate

The Plane-Mate transport vehicle shuttles passengers between the aircraft and the terminal gates. Passengers enter from the terminal departure level and exit at the aircraft door without changing elevations or being exposed to the elements. The Plane-Mate has seating for 83 and can accommodate 1 wheelchair passenger.

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(8) McCaffrey. W.F., and O'Brien, M.G., AIRCRAFT BOARDING OF WHEELCHAIR PASSENGERS - PHASE 2: DETAILED ASSESSMENT OF MECHANICAL BOARDING DEVICES, Transportation Development Centre, 1985.

Devices such as Plane-Mates, and galley trucks can safely service aircrafts ranging in size from a DC-9 to B-767. Plane-Mates are operated at 3 Airports in Canada:

16 @ Mirabel (owned and maintained by Transport Canada)
5 @ Edmonton (owned and maintained by Transport Canada)
1 @ Lester B. Pearson (owned by Air Canada)

The addition of in-cabin storage of personal wheelchairs has a minimal effect on the Boarding methods and procedures previously described. The only operating policy changes that would result are related to the safe storage of the wheelchair itself. Instead of retrieving the chair at the boarding device for cargo hold storage, the chair would be brought inside the cabin and stored by an airline flight attendant.

3.2 On-Board Wheelchairs

The concept of on-board wheelchairs was developed to give mobility impaired passengers access to washrooms during the flight.

These special chairs can typically be moved along 40.6 cm (16 in.) wide aisles. When the wheelchair is not in use, it is folded up and stored on board. The specifications of the Wilshire Air Chair are provided in Appendix A.

The addition of in-cabin storage of personal wheelchairs is not a substitute for carrier provided on-board wheelchairs. Except in rare cases, restricted aisle widths combined with the typical washroom locations preclude the use of a personal chair during flight. The only connection between these two services is the allocation of scarce storage space inside the aircraft cabin. For a carrier to provide both of these services, dedicated storage space must be found for the personal wheelchair as well as the on-board wheelchair.

3.3 Safe Stowage of Mobility Aids in the Cargo Hold

Wheelchairs and scooters are presently stored as last baggage and retrieved as first baggage on all air carriers. Specific packaging of electric scooters varies with carrier and aircraft type (i.e. disassembly, pallet storage, etc.). Storage of manual wheelchairs consists of merely storing the chair in the baggage compartment of the aircraft cargo hold. Air Canada provides a heavy gauge plastic bag, free of charge, in order to protect the chair. Regardless of these measures, each year a number of mobility aids are damaged or mishandled by the nation's carriers.

It is believed that the addition of in-cabin storage of personal wheelchairs would result in a reduction in the number of claims for damaged equipment. The associated inconvenience to passengers, which results from mishandled mobility aids, would also decrease. This reduction would occur as a result of less handling by the carrier and the use of dedicated storage areas.

3.4 Carriage of "Wet-Cell" Batteries used for Electric Wheelchairs or Scooters

Scooters which utilize "wet cell" batteries are transported by every carrier. The governing regulations in Canada are those as set out by the International Air Transport Association (IATA) (Appendix B). A typical "wet cell" battery is classified under Dangerous Goods as a Class 8 corrosive. As a result, scooter batteries must be stored such that no undue safety hazard shall be created. In the case of a scooter using wet electric storage batteries, the batteries must be securely fastened in the battery tray, the electric power cables disconnected, and the battery terminals positively protected against short circuit. The scooter must then be loaded and secured in an upright position in the cargo hold[9].

Due to handling limitations, the requirement of loading and securing the batteries and scooter in an upright position can only be met on wide body aircraft such as B-747 or L-1011[10].

Separate storage of "wet cell" batteries in the cargo hold of the aircraft involves packaging the battery in a safe manner as defined in the IATA Regulations.

Spill-resistant batteries called "gel cells" can also be used for powering electric scooters. This designation is achieved through the use of jelly type electrolyte. Gel cell batteries are more expensive than "wet cell", and, in general, do not give the same amp-hour ratings for a given size. Regulations regarding shipping of these batteries by air are similar to those for "wet-cells" and are also covered in detail by IATA Regulations.

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(9) TES Report #C360, Air Transport of Wheelchair Batteries, Transportation Development Centre, 1981, pg. 2

(10) Legault, Exhibit 9.

The advantages to passengers of in-cabin storage of scooters are minimized by these regulations, as the batteries must undergo a preparation procedure and ultimately be carried in the cargo hold.

3.5 Immediate Replacement for Lost or Damaged Items

A survey of major air carriers in 1986 indicated that without exception, repair services are provided for damaged mobility aids and passengers are reimbursed at current cost whenever a wheelchair is damaged or lost[11]. In addition, most carriers provide replacement wheelchairs or other mobility aids, on loan, when a wheelchair or aid has been sent for repair.

It is believed that the addition of in-cabin storage of personal mobility aids would eliminate the potential for a passenger to become separated from their wheelchair and also result in reduced claims for damage due to the use of a dedicated storage area.

3.6 Stowage Space for Personal Wheelchairs and Aids on all Aircraft

At present, no Canadian based carrier offers the option for mobility impaired passengers to store their personal wheelchair in the cabin of an aircraft. However Garuda Indonesia, the International Airline in Indonesia is reported to have such a policy[12]. Attempts made by Davis Engineering to confirm details on this service were contradictory. Garuda representatives in North America state that there is no special policy dealing with In-Cabin Wheelchair Storage.

It should be noted that In-Cabin Storage of personal wheelchairs is a separate issue from carrier owned on-board wheelchairs.

While the latter would offer the traveller access to the washrooms during lengthy flights, the former offers operational and logistic advantages to both the Carrier and Passenger (Appendix C)[13].

- Reduction in processing of wheelchairs for cargo storage (i.e. packaging, placement).

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(11) Legault, Exhibit 9.

(12) Ninnescah, Topics in the News, Sept/Oct 1987, Pg. 11.

(13) Ninnescah, Carriage in the Cabin, May/June 1987, pg. 7.

- Quicker boarding and deplaning for mobility impaired travellers.

- Reduction in damage claims.

- Easier access to personal wheelchairs during stopovers, connections and flight delays.

- Incentive for travellers to select a particular carrier and to use advanced booking in order to obtain the service.

4. CONSTRAINTS

The following sections address issues created by policy related and physical constraints.

4.1 Existing Policies

Any change in procedure, or any addition of equipment which will affect public transportation by air, must comply with minimum criteria for airworthiness and operational policies. The main considerations to be satisfied are as follows.

4.1.1 Government Policies and Regulations

4.1.1.1 Transport Canada Policy on Transportation of Disabled Passengers

Current government policy ("Policy on Transportation of Disabled Passengers", Transport Canada 1983) states:

- The Federal Government has a responsibility to ensure that reasonable, reliable, and equitable transportation services and facilities are available to able-bodied and disabled persons alike.

- Disabled persons are entitled to be treated with the same dignity, consistency, and consideration as are all other passengers when travelling, and to reserve services customarily available to the general public.

- Disabled passengers should not be subject to any unreasonable terms and conditions of carriage.

- All disabled travellers should be assumed to be self-reliant unless they, or their chosen representative, state otherwise (subject to the previous condition). Self-reliant, non-ambulatory, air travellers may be required to travel with attendants under conditions specified in most air carrier tariffs.

- Carriers should not be required to provide 'extraordinary care' of disabled passengers travelling, such as assistance in breathing, eating, or using washroom facilities. Assistance in routine boarding, deboarding, and moving to and from the washroom, where applicable, is not considered 'extraordinary care'.

- The onus should be on regulatory authorities and carriers to show why a limitation to travel should be imposed. The consumer should not be required to prove a right of access to a certain service[14].

4.1.1.2 Airworthiness Standards

In the event a wheelchair is to be stored in the cabin of an aircraft, the securement system and the storage location must meet certain minimum airworthiness standards as defined in the Airworthiness Manual, Chapter 525, Transport Category Aeroplanes[15]. Specifically, the following sections summarized below must be addressed. Appendix D contains reprints of the documents.

(a) Section 525.787 - Storage Compartments

Requires that storage compartments be designed for a maximum placarded weight when considering the loads specified in Section 525.561(b). A means of restraining the contents under the specified loads, must be provided. Lamps installed in the cargo area must not contact the cargo.

(b) Section 525.789 - Retention of Items of Mass in Passenger and Crew Compartments and Galleys.

Items built into the aircraft must also be able to withstand the loads defined in Section 525.561(b).

(c) Section 525.561 - Emergency Landing Conditions, General.

The supporting structure must be designed to withstand the following inertia forces:

(i)	Upward	- 2.0 g
(ii)	Forward	- 9.0 g
(iii)	Sideward	- 1.5 g
(iv)	Downward	- 4.5 g

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(14) McCaffery & O'Brien, Pg. 2.

(15) Transport Canada Aviation, Airworthiness Manual, Chapter 525, 1986.

(d) Section 525.853 - Compartment Interiors

Materials used in aircraft compartments occupied by the passengers or crew must be self extinguishing when testing under approved methods. Average burn length must not exceed 6 inches (15 cm) and the average flame time after removal of the flame source may not exceed fifteen (15) seconds. Drippings may not continue to flame for more than three (3) seconds after falling.

(e) Section 525.785 - Seats, berths, safety belts, and harnesses

Each projecting object that would injure persons seated or moving about the airplane in normal flight must be padded.

4.1.1.3 Charter of Rights and Freedoms

On April 17, 1982, the Charter of Rights and Freedoms was implemented. The potential ramifications of Section 15 of the Charter dealing with equality rights was seen to be of such consequence as to warrant a three year delay to allow ways to adjust[16].

The first part of Section 15 reads as follows:

"Every individual is equal before and under the law and has the right to equal protection and equal benefit of the law without discrimination and in particular, without discrimination based on race, national or ethnic origin, colour, religion, sex, age or mental or physical disability[17]."

4.1.2 Carriers' Policies

4.1.2.1 Canadian General Rules Tariff

As stated in "Rule 33" pertaining to the Canadian General Rules Tariff, "a carrier will refuse to transport or will remove at any point, any passenger whose mental or physical condition is such that as to render him incapable of caring for himself without assistance unless:

a) he/she is accompanied by an attendant who will be responsible for caring for him/her enroute, and

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(16) Ratushny, pg. 5

(17) Canada, The Charter of Rights and Freedoms - A Guide For Canadians, Minister of Supply and Services Canada, Ottawa, 1984.

b) with the care of such attendant, he will not require unreasonable attention or assistance from employees of the carrier."

4.1.2.2 Seating Policy

Seating restrictions are standard policy by all air carriers (Table 4.1). For reasons of safety, mobility impaired passengers are not permitted to sit in rows which are located adjacent to exits. Typically, mobility impaired passengers are seated 2 to 3 rows behind any exit door.

Airline seating policies regarding the mobility impaired vary between air carriers. Advance seat selection is available to the disabled on Air Canada, Canadian and Wardair. Quebecair provides no advance seat selection. Though all of the carriers do identify seats which provide greater accessibility, to some extent identification is limited to the aircraft with seats which have removable armrests[18].

4.2 Wheelchair Configuration

Besides meeting the regulatory constraints defined in Section 4.1, the "in-cabin" storage design concept must be compatible with the physical size and weight ranges of existing scooters and manual wheelchairs and the physical geometry of the subject aircraft.

4.2.1 Conventional-Collapsible-Manual-Wheelchair

The conventional modern wheelchair consists of a metal frame, two large rear wheels, and two small diameter front steering wheels (Figure 4.1). The Occupant sits in a seat which is suspended between the tubular steel framing members. The design has been developed based on the need for the Occupant to be able to self-propel the chair by gripping hand rails on the wheels. Furthermore, the structure must fold easily in order to facilitate storage. Foot rests are located forward of the front wheels to provide support for the user's feet.

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(18) Legault, pg. 71.

TABLE 4.1 "RULE 33", TRANSPORT OF DISABLED PASSENGERS (C.T.C.)

PASSENGERS CATEGORY	SELF RELIANT		NON SELF RELIANT	
	ATTENDANT REQUIRED	MAX.NBR PER FLIGHT	ATTENDANT REQUIRED	MAX.NBR PER FLIGHT
BLIND	NO	N/A	-	-
DEAF	NO	N/A	-	-
BLIND AND DEAF	YES	N/A	-	-
MENTALLY HANDICAPPED	NO	N/A	-	-
MENTALLY HANDICAPPED	-	-	YES	NO
AMBULATORY	NO	N/A	-	-
AMBULATORY	-	-	YES	N/A
NON-AMBULATORY	NO	*	-	-
NON-AMBULATORY	-	-	YES	*

* See Chart Below

WHEELCHAIR WCHP AND WCHC	RANDOM SEATING UNATTENDED/	RANDOM SEATING ADDITIONAL IF ATTENDED/	PLANNED SEATING UNATTENDED/	PLANNED SEATING ADDITIONAL IF ATTENDED/	TOTAL RANDOM + PLANNED	MAX. NR OF WCHC
B-747	9	9	9	9	36	5
B-747 COMBI	7	7	7	7	28	4
L-1011	6	6	6	6	24	4
L-1011-500	4	4	4	4	16	3
DC-10	6	4	5	5	20	3
B767	4	3	3	3	13	2
DC8-S	4	4	4	4	16	4
B727-200	3	2	2	4	11	4
B727-100	2	1	1	2	6	2
B727-100C (PW)	1	1	1	1	4	1
DC9	2	1	2	2	7	2
B737	3	2	2	2	9	2
B737 (COMBI) (PW)	1	2	1	1	5	1
B737 (COMBI) (ND)	1	1	NO PLANNED SEATING	NO PLANNED SEATING	2	1
BAC 111	1	1	1	1	4	1
FKF	1	1	NO PLANNED SEATING	NO PLANNED SEATING	2	1
CV580	1	1	NO PLANNED SEATING	NO PLANNED SEATING	2	1
HS748	2	2	NO PLANNED SEATING	NO PLANNED SEATING	4	1

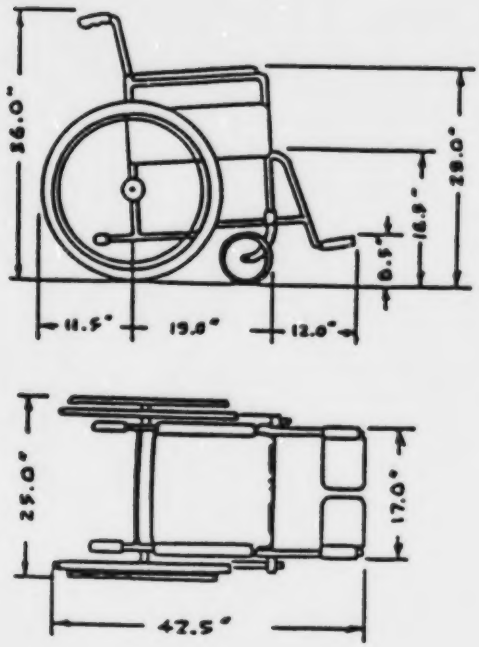

Figure 4.1 Conventional Wheelchair Dimensions[19]

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(19) Woodson, Human Factors Design Handbook, 1981, pg. 190.

The average dimensions of a conventional wheelchair are approximately:

Length:	120 cm	(47.2 in)
Width:	64 cm	(25.2 in)
Height:	91 cm	(35.8 in) (push handles)

The width can vary from 46 cm (18.1 in), for a child's model, to 71 cm (28.0 in) for a large adult's model. The seat is approximately 49.5 cm (19.5 in) from the ground. To conserve space while stowed, the chair collapses. A 64 cm (25.2 in) wide chair will collapse to 27 cm (10.6 in).

Steering the conventional wheelchair is accomplished by rotating one wheel more than the other. The difference causes the chair to rotate. The front wheels castor is necessary to accommodate the turn. Dimensional information is contained in Appendix E.

4.2.2 Scooter

The scooter is based on a tricycle style configuration. Different models use small diameter single or double wheels at each of the three support points. The wheels are solid and the tires are pneumatic (Figure 4.2).

The armchair style seat is mounted on a pedestal above the platform chassis. The assembled dimensions of a typical model, which is representative of the various models on the market, are:

Length:	114 cm to 124 cm (44.9 in to 48.8 in), adjustable
Width :	61 cm (24.0 in)
Height:	100 cm (39.4 in) (top of seat back)
	74 cm (29.1 in) (top of tiller handles)

The seat height is variable from 47 cm to 55 cm (18.5 in to 21.7 in).

Power for the scooter is generally provided by one, or two, 12V "gel cell" batteries. The rechargeable batteries, which provide up to 32.2 km (20 miles) of use, are usually located under the pedestal seat on the chassis platform.

Two configurations of the drive train are common. One utilizes a "power head", which is a motor driving the single front wheel. Another version operates a motor transmission system on the rear wheels. Steering is accomplished by moving the handlebars, or tiller.

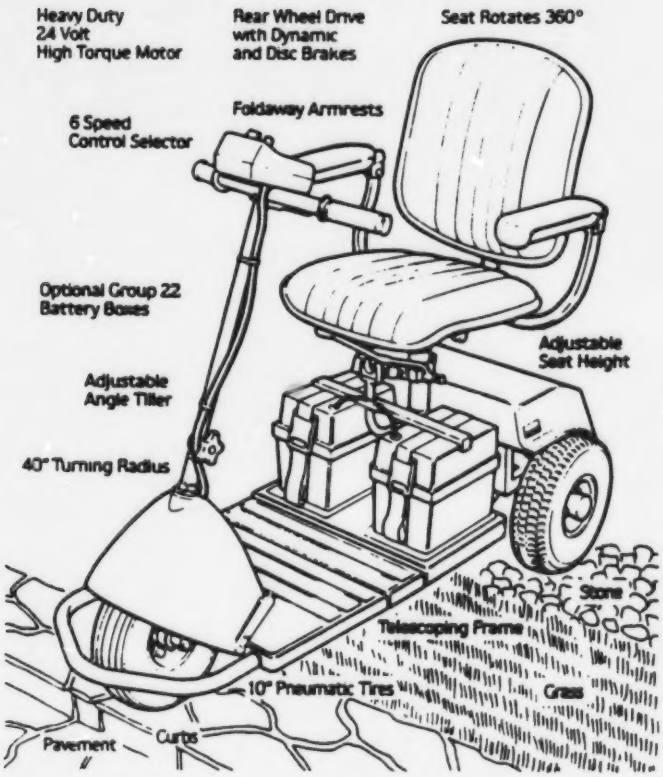


Figure 4.2 Scooter[20]

(20) Fortress Scientific, If Walking is Diccult - Model 2000FS Electric 3-Wheeler, FS-1023, Rev. 5/86, pg. 4.

Unlike the conventional manual wheelchair, which collapses to facilitate storage, the typical scooter breaks down into four or five sections which may include the seat, the platform, the front wheel/motor, the handlebars, and the batteries.

Figure 4.3 illustrates the disassembled "Mobie" scooter. The approximate dimensions of the individual components are:

(a) Base - 40 cm x 60 cm x 91 cm (15.7 in x 23.6 in x 35.8 in)
(b) Power Head - 42 cm x 24 cm x 27 cm (16.5 in x 9.5 in x 10.6 in)
(c) Seat - 75 cm x 67 cm x 45 cm (29.5 in x 26.4 in x 17.7 in)
(d) Tiller - 75 cm x 42 cm x 15 cm (29.5 in x 16.5 in x 5.9 in)
(e) Batteries - 22 cm x 17 cm x 23 cm (x 2) (8.7 in x 5.7 in x 9.1 in) (x2)

Scooter information is contained in Appendix F.

4.3 Wheelchair Size Parameters

This section compares some of the differences in physical dimensions between the conventional manual wheelchair and motorized scooters.

4.3.1 Wheel Base

Conventional Wheelchair - approximately 40 cm (15.7 in)
Scooter - approximately 71 cm (28.0 in)

The significant difference in the wheel base is due to the size of the wheels and the position of the wheels with respect to the Occupant's body. Since the scooter is equipped with small wheels and the front wheel is located in front of the passengers' feet, to enable handlebar steering, a relatively long wheelbase results.

4.3.2 Wheel Track

Conventional Wheelchair - approximately 64 cm (25.2 in)
Scooter - approximately 61 cm (24.0 in)

The difference in the wheel track is a function of the location and size of the rear wheels. The larger wheels on the conventional wheelchair must be placed outside of the boundaries defined by the seat and the user's body.

Figure 4.3 Disassembled Scooter

4.3.3 Turning Area/Radius

Conventional wheelchair (without attendant)	-	127 cm x 127 cm (50.0 in x 50.0 in)
Conventional wheelchair (with attendant)	-	152 cm x 152 (59.8 in x 59.8 in)
Scooter	-	203 cm x 102 cm (79.9 in x 40.2 in)

The conventional wheelchair can rotate on its own axis giving it a turning radius of approximately 40 cm (15.7 in). The extensions on the front of the chair will increase this by as much as 20 cm (7.9 in). In contrast, the scooter requires a turning radius of approximately 100 cm (39.4 in).

4.3.4 Length

Although there is a significant difference in the wheelbase of the conventional wheelchair when compared to the scooter, the typical length of the two devices is the same:

Conventional wheelchair (with footrests)	-	Nominal 120 cm (47.2 in)
Scooter	-	Nominal 120 cm (47.2 in)

The length of the conventional wheelchair is heavily dependent on the extension at the front of the chair and the amount that the seat back is reclined. The extension length can vary by as much as 14 cm (5.5 in). Extensions can be quickly removed.

4.3.5 Width

When collapsed, the standard wheelchair is 33 cm (13.0 in) wide. The scooter has very little adjustment in the maximum width. Although some manufacturers provide for an adjustment of the wheel track, to increase the lateral stability for various seat heights; the typical minimum width is approximately 56 cm.

4.3.6 Weight

Although heavily dependent on the make and model; conventional wheelchairs weigh between 16 kg (35.3 lb) and 30 kg (66.2 lb). Scooters weighing as much as 53 kg (116.7 lb) (including two 10 kg batteries) are not uncommon. The maximum weight of a single piece, in the case of the Mobie (by Everest and Jennings) is 13 kg (28.7 lb).

4.3.7 Minimum Volume

Based on the dimensions presented in the previous sections the minimum volume for the three configurations would be:

(a) Collapsed Conventional Wheelchair
33 cm x 91 cm x 120 cm = 0.360 m^3
(13.0 in x 35.8 in x 47.2 in = 12.7 ft^3)

(b) Assembled Scooter
74 cm x 61 cm x 120 cm = 0.542 m^3
(29.1 in x 24.0 in x 47.2 in = 19.1 ft^3)

(c) Disassembled Scooter
= 0.597 m^3 (21.1 ft^3)

The minimum volume has been defined as the volume into which the wheelchair or scooter would fit (collapsed, assembled, or disassembled). It may be possible to optimize the required volume of the disassembled scooter by stacking the individual components.

4.3.8 Minimum Floor Space

Based on the dimensions presented in the previous sections, the minimum floor space for the three configurations would be:

(a) Collapsed Conventional Wheelchair
33 cm x 120 cm = 0.396 m^2
(13.0 in x 47.2 in = 4.3 ft^2)

(b) Assembled Scooter (Wheels on Floor)
61 cm x 120 cm = 0.732 m^2
(24.0 in x 47.2 in = 7.9 ft^2)

(c) Disassembled Scooter (Base Flat)
67 cm x 97cm = 0.650 m^2
(26.4 in x 38.2 in = 7.0 ft^2)

The minimum floor space has been defined as the minimum area into which the wheelchair or scooter could be placed assuming an adequate height availability.

4.4 Cabin Size/Layout by Aircraft Type

Drawings supplied by Air Canada (Appendix G) were reviewed for information regarding aisle widths, turning radii, and possible in-cabin storage locations for personal wheelchairs and scooters. A review of Air Canada's cabin layouts for DC-9, B-727, B-747, B-767 and

L1011 aircraft by Davis Engineering revealed several possible storage locations based on dimensional constraints only. Subsequent field trials were then arranged with the cooperation of Air Canada, the Ottawa International Airport and Bamford-Regis (supplier of wheelchairs and scooters) The goal of the field trials was to verify the suitability of the potential storage areas. Both a collapsible, manual wheelchair (Everest and Jennings Traveller) and a scooter (Fortress Scientific 3000) were taken on board three aircraft, the DC-9, the B-727 and the B-767.

Operational data regarding scooter disassembly time and the closest approach to potential storage locations was also recorded.

4.4.1 Cabin Geometry

After reviewing the floor plan layout drawings, it became evident that in general, access to cabin seating by a passenger in their own personal wheelchair would be impossible (Table 4.2). Transfer to an aisle wheelchair is necessary before boarding the aircraft.

Potential in-cabin storage sites were identified on a dimensional basis only (Table 4.3).

4.4.2 Threshold Style

All aircraft used by major airlines have threshold designs which permit wheeled devices to cross from the boarding bridge to the aircraft.

4.4.3 Turning Area

Two of the aircraft which were investigated during the project (DC-9 and B-727) exhibited a very restricted entrance area at the front door/aisle area. In the case of the DC-9, the Fortress Scientific scooter could not be negotiated around the bend.

4.5 Other Considerations

Deployment time and compatibility with carrier operational policies are critical if the carrier is to stay on schedule. This constraint is of particular importance as storage and retrieval of the wheelchair or scooter takes place at a time of high workload for flight attendants and ground crew.

Table 4.2 Wheelchair Access Restrictions

AIRCRAFT	AIR CANADA DRAWING NUMBER	PROBLEM AREAS
B-727	05-40128	-Folding doors from forward galley to lst row of seats ≅53.3 cm (21.0 in)
747-233	05-30161	-Access to first class around stairwell ≅61.0 cm (24.0 in) -Aisle width between seat rows typically 50.8 cm (20.0 in)
L1011-500	05-50174	-Aisle width between first class seats ≅50-64 cm (20.0 - 25.0 in) typically -Aisle width between lst row of seats, galley and closet, port side ≅63.5 cm (25.0 in)
727	05-40025	-Aisle width between seats ≅45.7 cm (18.0 in) -Marginal access from rear doors to last seats
747	05-30223	-Aisle width between seats typically ≅57.1 cm (22.5 in)
767	05-60038	-Aisle width between seats ≅48.3 cm (19.0 in), no access to seats from rear -Front access to seat row #1 ≅64.8 cm (25.5 in)
DC-9/32	05-70310	-Aisle width between seats ≅48.3 cm (19.0 in)
L1101	05-50205	-No access to seats from rear -Aisle width between seats ≅ 55.9 cm (22.0 in)

Table 4.3 Potential In-Cabin Wheelchair Storage Locations

AIRCRAFT	AIR CANADA DRAWING NUMBER	POSSIBLE STORAGE LOCATION
727	05-40128	- Crew coat room - Passenger coat room forward - Rear coat room - Rear storage closet
747-233	05-30161	- Coat closets - Pallet area from rear access door - Forward storage area (stbd)
L1011-500	05-50174	- Forward coat closet - Rear coat room - Rear storage area
727	05-40025	- Rear storage areas, port and stbd - Forward C.O.B. storage area
747	05-30223	- Forward storage area near galley complex - Rear storage and crew storage areas
767	05-60038	- Designator area "A" - Mid cabin coat room - Aft storage near galley
DC-9/32	05-70310	- C.O.B. storage areas
L1101	05-50205	- Storage rear coat room - Mid cabin garment bag storage area

C.O.B. - Carry-On Baggage Unit

5. POTENTIAL STORAGE LOCATIONS

The results of the storage trials were compared to the relevant cabin layout drawings, aircraft diagrams (supplies and amenities), and aircraft storage data to determine if there is space which can be allocated to in-cabin wheelchair storage.

The results, based on the subject aircraft, indicate that storage of a collapsed manual wheelchair is possible in three general locations:

- Storage in carry-on baggage (C.O.B.) units;
- Bulkhead mounting storage locations;
- Existing cabinets (other than C.O.B.).

This assessment was based on dimensional constraints only. None of these spaces are large enough to accommodate an assembled or a disassembled scooter.

5.1 Carry-On Baggage Unit (C.O.B)

On some aircraft, such as the Boeing 727 and the McDonnell Douglas DC-9, carry-on baggage units (C.O.B.) are installed (Figure 5.1). The C.O.B. closets are attached to the floor tracks and span the width of 3 seats. Within each C.O.B. unit are two shelves that fold in half depthwise such that tall items, such as suit bags, can be hung from the rack at the front of the closet, while still allowing some shelving space at the back for additional storage. The C.O.B. is closed by a roll-top security door which runs down from the roof of the unit. It is secured around the complete periphery. At the bottom of the door is 10.2 cm (4.0 in) lip.

The depth of the C.O.B. is 118.1 cm (46.5 in), the width 71.1 cm (28.0 in), and the height 128.3 cm (50.5 in). There is sufficient depth that if the shelves, which are presently in the C.O.B., were modified such that they folded widthwise, as opposed to depthwise, it would be possible to position a manual wheelchair inside such that it was up against the forward wall of the C.O.B. In terms of overall dimensions, the volume of the C.O.B. is approximately 1.08 m^3 (38.1 ft^3). Given that the volume of the collapsed wheelchair is 0.360 m^3 (12.7 ft^3), approximately 33% of the C.O.B. would be used by the collapsed manual wheelchair. In terms of utilization of the width of the C.O.B., given that the total width is 71.1 cm (28.0 in) and the collapsed width of the manual wheelchair is approximately 33.0 cm (13.0 in), there is a

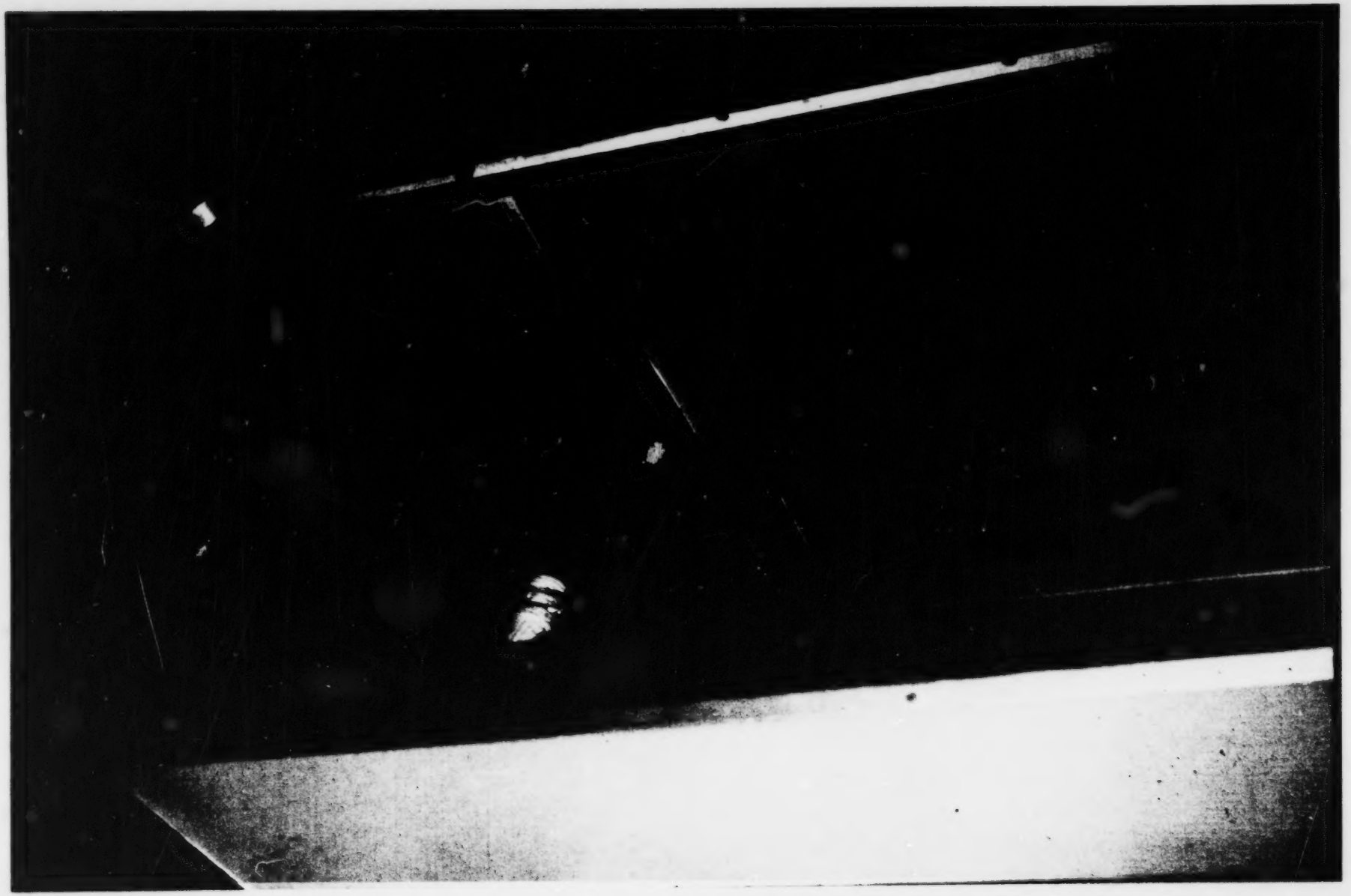


Figure 5.1 Typical Carry-On Baggage Unit

total utilization of approximately 46% of the overall width. It would be necessary to remove the foot extensions from the wheelchair in order to facilitate installation in the modified C.O.B.; however, this is a simple procedure based on the experience with the Everest and Jennings Traveller wheelchair.

Attempts were made to contact the manufacturer of the C.O.B. unit, KME Manufacturing in Washington. Unfortunately, this company would not release information specific to the design of the C.O.B. so that Davis could explore the possibilities of making modifications. Even without modifications to the C.O.B. however, it is possible to position a manual wheelchair such that it fits crosswise in the cabinet (Figure 5.2). This is an undesirable situation because storage area at the rear of the closet would be blocked.

5.2 Bulkhead Mounting

Another option which became evident during the field evaluation of the B-727 was mounting the collapsed wheelchair against the bulkhead in the galley at the rear of the aircraft (Figure 5.3).

This option was not pursued because with the wheelchair in place, the aisle width adjacent to the rear port emergency door will be reduced by approximately 33.0 cm (13.0 in). Furthermore, Section 525.785(e) of the Airworthiness Manual, Chapter 525, requires that projecting objects be padded to prevent injury to personnel moving about the aircraft. A method of protecting the passengers and the wheelchairs from each other would therefore have to be provided. Subsection (h)(2)(ii) of the same section requires that flight attendant seats must "be positioned so that when not in use they will not interfere with the use of passageways and exists." By comparison this effectively negates the use of this location.

5.3 Existing Cabinetry

During the trials of the B-727 two existing cabinets were found to be dimensionally adequate to store a collapsed manual wheelchair with the foot extensions removed. The first is located at the front of the cabin on the port side, and the second in the rear section of the cabin on the starboard side. Both these areas contain lifejackets, pillows and other equipment at present, highlighting again the basic problem with in-cabin storage of wheelchairs, competition for limited space.

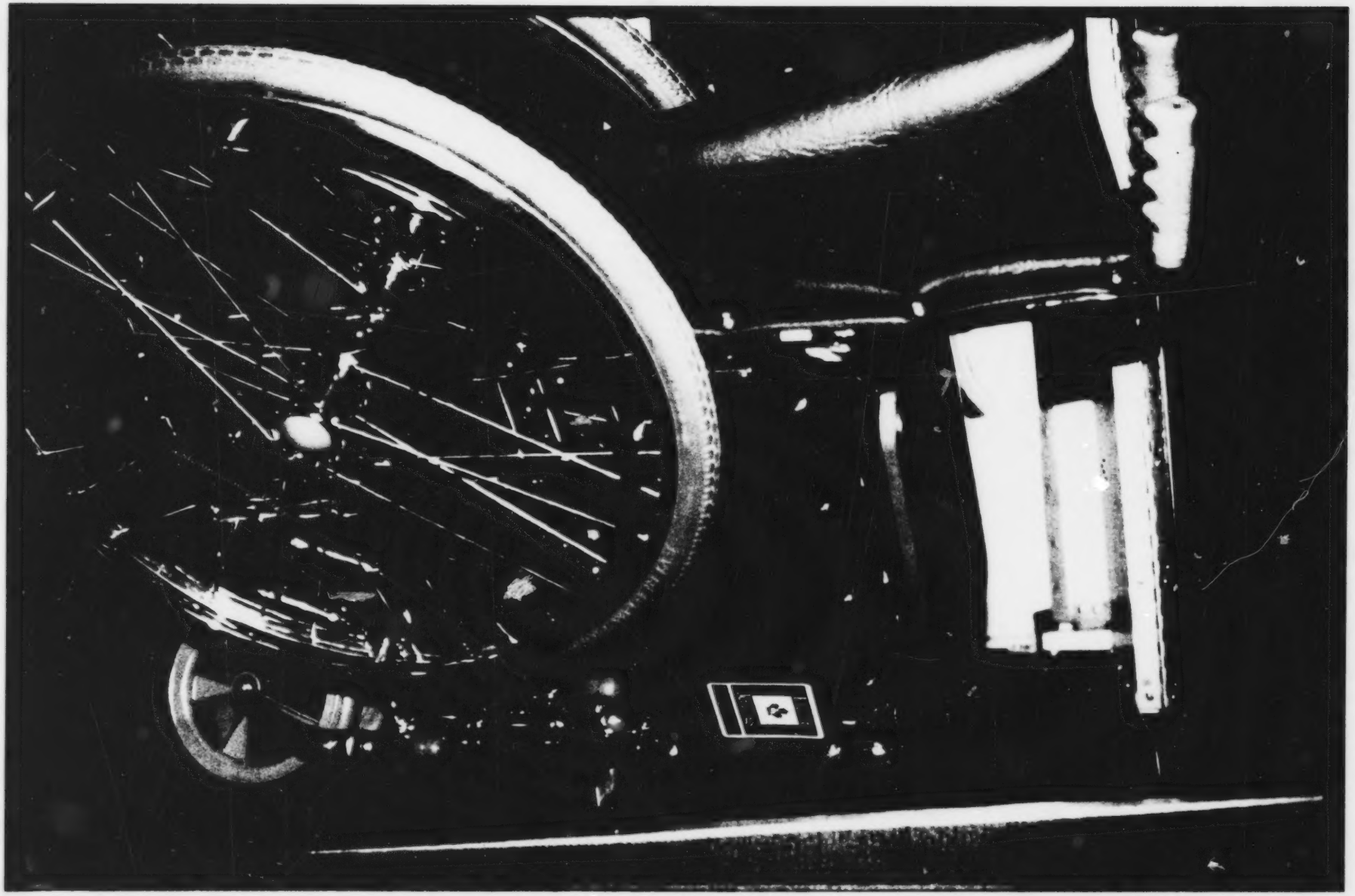


Figure 5.2 Wheelchair Stowed in Carry-On Baggage Unit

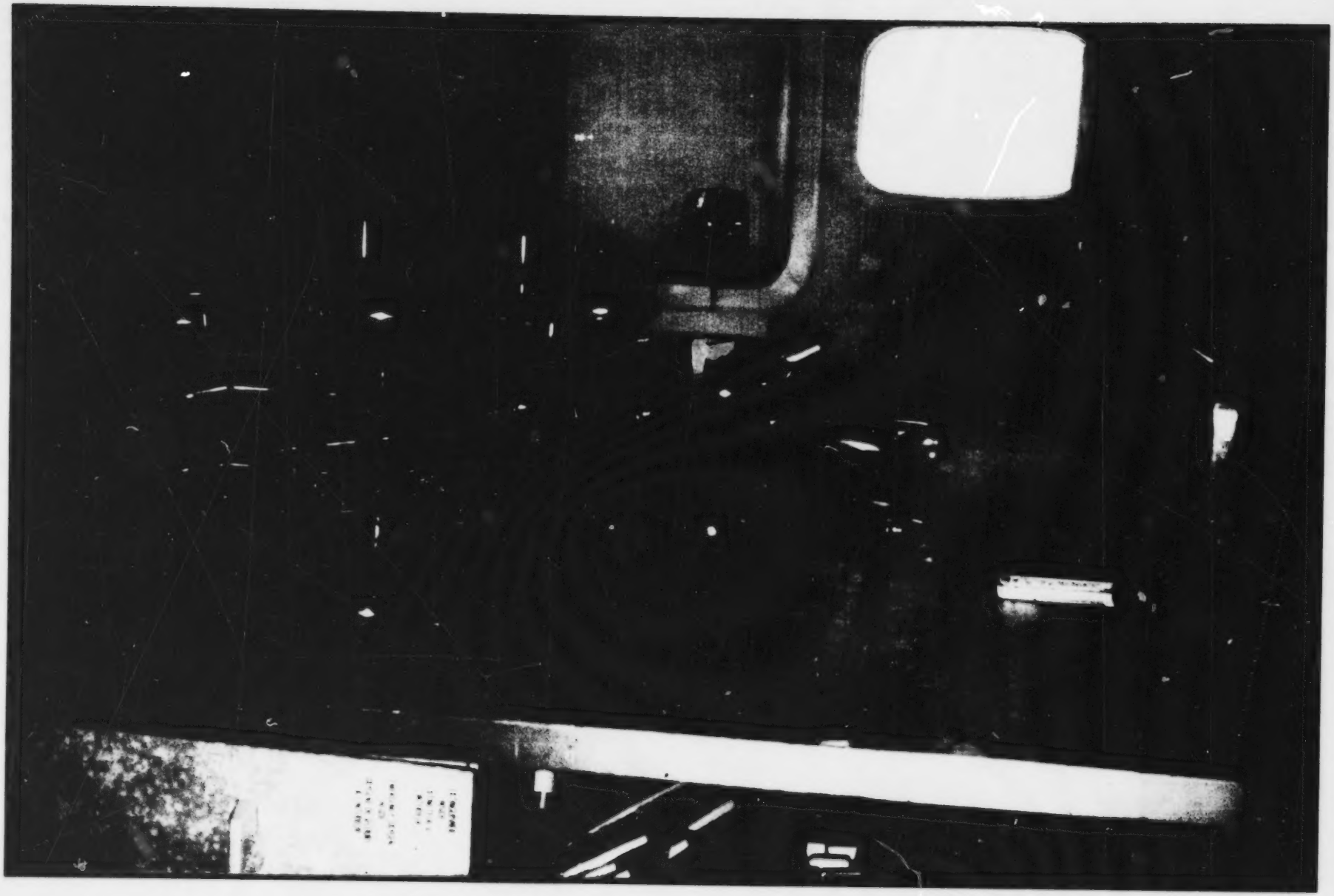


Figure 5.3 Bulkhead Mounting Location B-727

6. SECUREMENT DESIGN

"In-cabin" wheelchair storage concepts fall into three basic implementation categories:

- Purchasing new aircraft
- Retrofitting existing storage areas
- Assigning of new storage areas in existing aircraft

For the purposes of this report, new aircraft purchase specifications are not considered; however, the information in Section 4.2 does provide the basic requirements, should new aircraft designers wish to incorporate specific wheelchair/scooter storage areas.

6.1 Scooters

All concepts presented are based upon the storage of collapsible manual wheelchairs. Several factors make the "in-cabin" storage of motorized scooters impractical; they are:

6.1.1 Dimensional Restrictions

During the trials conducted for this Report, attempts were made to stow a dismantled scooter inside the C.O.B. units of both a DC-9 and a B-727. The components took up all of the available space even with the parts stacked in an unacceptable configuration. No alternate storage areas were found.

6.1.2 Operational Difficulties

Typically 3-5 minutes are required to dismantle the motorized scooter for storage. This task would come at a very busy time in the pre-flight schedule if done at the loading bridge. Furthermore, irregardless of where the scooter is stored, the electric storage batteries must be prepared as defined by the IATA Regulations and stowed in the cargo hold. A fully operational scooter cannot be stowed in the cabin even with adequate space available.

6.2 "In-Cabin" Wheelchair Storage Concepts

Based on cabin layout drawings, which were supplied by Air Canada, and data collected during field trials on DC-9, B-727 and B-767 with a manual wheelchair, the following securement concepts were developed:

- Installation inside a modified C.O.B. unit;
- Seats removed and mounting bar installed.

6.2.1 Installation Inside Modified C.O.B. Unit

The C.O.B. units, which were evaluated during the field trials, were able to contain a manual wheelchair; however, the accessible storage space for other items was severely reduced because the wheelchair had to be placed across the front of the cabinet.

A modification to this closet would be the replacement of one or both (depending on model) rearward folding shelves with sideways folding units, and the addition of recessed tiedown fittings (Figure 6.1). The result would be a C.O.B. unit, which is unchanged as far as normal storage is concerned, but with the capability of storing one manual wheelchair when required. When in use, between 1/3 and 1/2 of the existing shelf space (depending on model) would be consumed with full accessibility to the remainder of the unit.

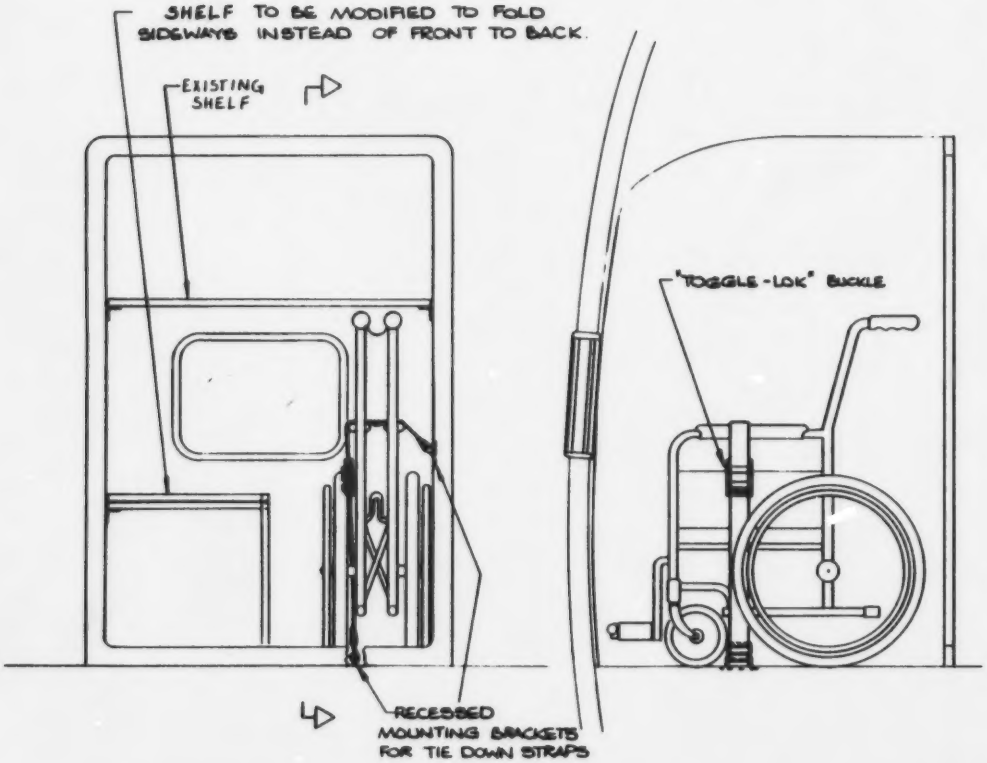
In order to address the Airworthiness Standards, the storage position would be against the forward wall of the C.O.B. unit. In this way, the structure of the unit would withstand the forward loading (i.e. 9.0 g). The tie down system would restrain the collapsed wheelchair securely against the wall during upward (2.0 g) and sideward (1.5 g) transients.

This storage/securement method would also have a minimal impact on the overall weight of the aircraft. Note that the present weight of the C.O.B. is approximately 80 kg (175 lb).

6.2.2 Seats Removed and Mounting Bar Installed

To facilitate storage of more than one wheelchair, new storage space could be created at the expense of revenue generating areas. In one concept, a three-seat module would be removed from the last row of seats. The seats would be replaced with a wheelchair mounting bar installed in the aircraft using the floor channels (Figure 6.2). Using this concept four collapsed manual wheelchairs could be stored in the aircraft cabin. This concept is compatible with all other aircraft equipment. Neither existing storage or passenger service is hindered in any way.

The major drawbacks include the time required to remove the seats, install the bar, and stow four wheelchairs. The costs associated with lost revenues is a financial drawback. Handling of the seats until they can be replaced is a logistics drawback.


SHELF TO BE MODIFIED TO FOLD SIDEWAYS INSTEAD OF FRONT TO BACK.
EXISTING SHELF
"TOGGLE-LOK" BUCKLE
RECESSED MOUNTING BRACKETS FOR TIE DOWN STRAPS

ITEM	QTY	PART NO.	DESCRIPTION	MATERIAL

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APPROVED		DATE
Q.A. APPROVED		DATE

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W.B. DAVIS ENGINEERING LTD. OTTAWA CANADA

TITLE: INSTALLATION INSIDE MODIFIED C.O.B. UNIT

CONTRACT NAME: FEASIBILITY STUDY WHEELCHAIR IN-CABIN STOWAGE

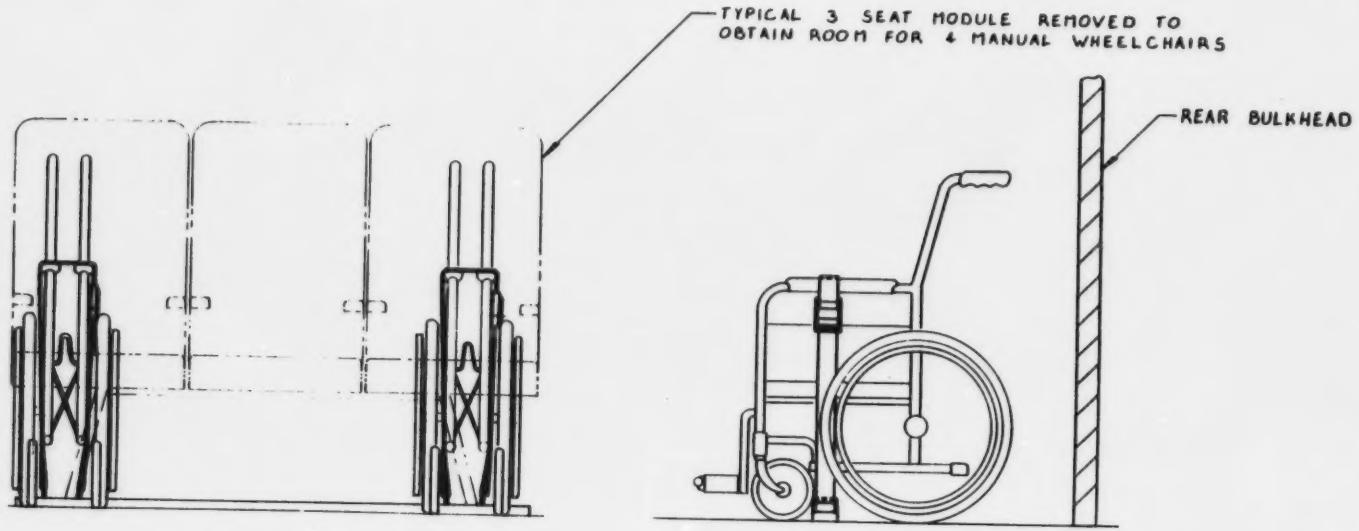
ISSUE NO. 86-168

DRAWING NO. SK-782

REV. 0

SHT 1 OF 1

Figure 6.1 Installation Inside Modified C.O.B



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W.A. DAVIS ENGINEERING LTD. OTTAWA CANADA

TITLE: SEATS REMOVED ♦ MOUNTING BAR INSTALLED

CONTRACT NAME: FEASIBILITY STUDY WHEELCHAIR IN-CABIN STOWAGE
CONT. NO. 86-149

DRAWING NO. SK-783 REV. 0

SIZE A2 SHT 1 OF 1

Figure 6.2 Seats Removed and Mounting Bar Installed

6.3 Operational Considerations

The success of any "in-cabin" storage concept relies as much on operational considerations as it does on design criteria. The procedure to stow the manual wheelchair must not interfere with the operations which are ongoing in the aircraft. Typical operations include station duties and en route cabin services.

6.4 Securement System Discussions

The modified C.O.B. concept presented for "in-cabin" storage of personal wheelchairs does not require lengthy deployment time or the use of special tools by cabin personnel. The additional duties, which are required of carrier personnel, begin when the Passenger is transferred into an airport wheelchair at the check-in counter or at the boarding device. At this point, current procedures dictate that the personal wheelchair is taken by ground personnel to the cargo hold. With "in-cabin" storage, the flight attendant would have to collapse the wheelchair and wheel it to the storage/securement device inside the cabin. Once the wheelchair is at the storage location, whatever storage procedure applicable is performed (e.g. fasten straps, etc.). Upon landing, the reverse operations are performed and the task ends when the Passenger is back in the personal wheelchair on the boarding device.

By definition, the concept presented represents a major modification as defined in Transport Canada Aviation Engineering and Inspection Manual. Part I, Chapter 1, Section 1.12 (Appendix H).

Since the C.O.B. modification change is not needed to satisfy airworthiness standards, the procedure required to certify the change would have to be instigated by an air carrier.

Subsequent approval of a proposed modification to an existing certified package, such as a C.O.B., is conducted by the Airworthiness Engineering Section, Airworthiness Division, Civil Aviation Branch of Transport Canada. Contact with representatives of this office revealed that over 550 major modifications were processed in 1986 and a change such as the one outlined in Section 6.2.1 would be handled in a routine manner.

7. CONCLUSIONS

As a result of this study, the following conclusions regarding the feasibility of "in-cabin" storage of scooters and wheelchairs, are submitted.

7.1 Storage of Motorized Scooters

"In-cabin" storage of scooters is not feasible. This is due to:

- The time required to dismantle the scooter,
- The batteries which have to be specially packed, regardless of where the scooter is stored,
- Difficulty in maneuvering the assembled scooter within the aircraft,
- The weight of individual components of the scooter,
- The volume of the scooter, both in the assembled and disassembled states.

7.2 Stowage of a Conventional Collapsible Manual Wheelchair

Without the assignment of a dedicated storage area on all aircraft, no generic restraint system is possible.

However, storage of one conventional manual wheelchair has been shown to be dimensionally possible during field trials in the B-727 and DC-9 aircraft. Potential locations were identified on other aircraft (B-747, L1011); however, in-situ evaluations were not possible to verify the suitability of these locations due to aircraft scheduling constraints.

7.3 Storage Locations

Storage locations identified based on dimensional constraints during the field trials are:

- Carry-on Baggage Units (C.O.B.)
- Bulkhead mounting
- Existing cabinetry

Bulkhead mounting was not pursued because of a conflict with Airworthiness Standards. Existing cabinetry is currently fully utilized for essential equipment.

7.4 Carry On Baggage Unit

The most promising storage location for aircraft, such as the DC-9 and the B-727, is deemed to be the carry-on baggage unit. Airlines presently require the existing C.O.B. units to meet the minimum carry-on baggage requirements. Usage of the C.O.B., particularly in high load situations, will decrease the amount of storage space available for other passengers.

In-cabin storage of personal wheelchairs cannot, however, be based solely on C.O.B.s because many aircraft types are not equipped with them. Retrofits of older aircraft have seen C.O.B. units removed and larger overhead storage bins installed to facilitate an increased seating capacity without sacrificing total storage volume.

7.5 Seat Access

Aircraft cabin geometry makes access into the cabin by a passenger in a personal wheelchair impossible in most cases. The acceptance of in-cabin storage for manual wheelchairs should not be construed as an indication that the passenger will not have to transfer from the personal wheelchair to the airport aisle wheelchair in order to gain access to their seat.

7.6 Cost Effectiveness

Based on the results of this study it is difficult to ascertain whether this service would be cost effective. In order to come to a definite conclusion, regarding this aspect of the service, the potential benefits, which could be quantified, such as:

- decreased insurance premiums on the part of the currier, due to decreased wheelchair damage,
- increased usage of an airline by wheelchair owners,

would have to be weighed against quantifiable costs such as:

- system development costs,
- procurement costs,
- installation costs,
- decreased revenue if dedicated seat space must be allocated,
- decreased revenue if the number of passengers, who use a given airline, decreases due to a perception that service is suffering as a result of the decrease in the carry on baggage allowance.

The potential benefits associated with increased convenience and increased peace-of-mind from the traveller's point of view cannot be quantified. Passenger surveys and an in-service evaluation program would have to be conducted to determine which of these benefits, if any, would materialize.

8. RECOMMENDATIONS

As a result of this study, the following recommendations are submitted by Davis Engineering Limited:

- Conduct an In-service Evaluation Program using one, or more, modified C.O.B. units on aircraft such as the B-727 or the DC-9 (Section 9.0).

- Continue to pursue the manufacturers of C.O.B. units to determine at what cost modifications to the C.O.B. can be made. Such companies may be ideal partners to work with during the in-service evaluation and preparation of a compliance program for re-certification of the unit.

9. PROPOSED IN-SERVICE EVALUATION

9.1 Project Tasks and Methodology

Davis Engineering proposes that an In-service Evaluation Program be done with the co-operation of a commercial carrier. This program will quantify operational difficulties and benefits associated with In-cabin wheelchair storage. The project would be subdivided into three phases:

Phase I - Detailed Design/Cost Evaluation
Phase II - Prototype Fabrication
Phase III - Field Trials

In this way, the potential success of the project can be evaluated at "GO/NO GO" points during the project.

Due to the widely varying floor layouts in commercial aircraft, no one securement concept is likely to meet all needs. In addition, flight duration and point of origin will affect the success of any evaluation.

The in-service evaluation defined in this section is based on the modified C.O.B. approach defined in Section 6.2.1 due to:

- the perceived potential for success,
- the relatively low cost associated with implementing the system in a prototype state,
- the extensive use of C.O.B.s on existing aircraft.

A well designed program should include both small and large airports and incorporate as many routes as possible. For the purposes of this proposal, it will be assumed that one securement system is to be tested, on one aircraft type, originating from both small and large airports. A minimum of 100 events should be logged with data collected from flight attendants, ticket agents and the handicapped traveller.

Data acquisition should vary from time and motion studies to questionnaires and checklists completed by participants.

The tasks and/or activities which are required to complete these phases are described below and a tentative schedule is provided in Figure 9.1.

9.1.1 Phase I: Detailed Design/Cost Evaluation

Task 1 Project Management

Overall project coordination, including:
- Liaison with client
- Coordination of the project team
- Contract Administration
- Budgeting and scheduling

Task 2 Conceptual Review

- Structural/Mechanical Concept Optimization
- Confirmation of C.O.B. Type, Structural Details, Dimensional Review

Task 3 Detailed Design

- Stress Analysis/Deflection by Finite Element Modelling
- Structural Design
- Mechanical Design
- Preparation of Drawing Package
- System Optimization
- Re-certification Plan

Task 4 Cost Evaluation

- Source components/services necessary for modification and preparation of the prototype
- Determine prototype and multiple unit cost in conjunction with carrier and basic C.O.B. manufacturer.

Task 5 Operational Integration

- Integrate concept into carrier's operational procedures
- Evaluate ergonomic considerations.

Task 6 Report

- Document results of detailed design and cost evaluation
- Present Drawing Package and Compliance Program.

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DSS-MAS 9143-3 (4/81)

CONTRACT PLAN AND REPORT FORM – FORMULE DE PROJET DE CONTRAT ET DE RAPPORT

CONTRACT TITLE – TITRE DU CONTRAT

CONTRACTOR – ENTREPRENEUR

PHASE I - DETAILED DESIGN/
COST EVALUATION

FILE NO. – Nº DU DOSSIER	SERIAL NO. – Nº DE SÉRIE
N/A	N/A

TASK DESCRIPTION / DESCRIPTION DE LA TÂCHE	TASK DURATION IN MONTHS – DURÉE DE LA TÂCHE EN MOIS												TASK COST – COÛT DE LA TÂCHE		
	1	2	3	4	5	6	7	8	9	10	11	12	PLANNED / PRÉVU À L'ORIGINE	ACTUAL / PRÉCÉDEMMENT	E.T.C. / À VENIR
(1) Project Management													2.0K		
(2) Conceptual Review													4.5K		
(3) Detailed Design													10.1K		
(4) Cost Evaluation													5.1K		
Operational (5) Integration													4.4K		
(6) Report													4.0K		
PLANNED COST BY MONTH / COÛT PRÉVU POUR CHAQUE MOIS	7.5K	9.9K	9.5K	3.2K									PLAN 30.1K		
ACT. PRÉCÉD. / E.T.C. BY MONTH / PRÉVISION POUR CH. MOIS														ACTUAL / COÛTS RÉELS	E.T.C. / À VENIR

Figure 9.1(a) Project Schedule

9.1.2 Phase II Prototype Fabrication

Task 1 Project Management

Overall project coordination, including:
- Liaison with client
- Coordination of the project team
- Contract Administration
- Budgeting and scheduling

Task 2 Procurement

- Obtain basic C.O.B.(s) from carrier or original manufacturer as appropriate
- Procure Components/Material Services based on results of Phase I, Task 4.

Task 3 Machining/Fabrication/Assembly

- Machine/Fabricate modified components (as required)

Task 4 In-Plant Evaluation

- Conduct preliminary tests to ensure:
- Compatibility with collapsible manual wheelchair types
- Ease of operation

Task 5 Re Certification

- Re-certify as defined in Section 6.4.

Task 6 Installation

- Aircraft Preparation (by carrier)
- Shipping
- Installation (by carrier)

Task 7 Documentation

- Preparation of Manual
- Preparation of Spare Parts and Maintenance Documents (as required)

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CONTRACT PLAN AND REPORT FORM – FORMULE DE PROJET DE CONTRAT ET DE RAPPORT

DSS-MAS 9143-3 (4/81)

CONTRACT TITLE – TITRE DU CONTRAT

PHASE II - PROTOTYPE FABRICATION

CONTRACTOR – ENTREPRENEUR

FILE NO. – Nº DU DOSSIER	SERIAL NO. – Nº DE SÉRIE
N/A	N/A

TASK DESCRIPTION DESCRIPTION DE LA TÂCHE	TASK DURATION IN MONTHS – DURÉE DE LA TÂCHE EN MOIS												TASK COST – COÛT DE LA TÂCHE		
	1	2	3	4	5	6	7	8	9	10	11	12	PLANNED PRÉVU À L'ORIGINE	ACTUAL PRÉCÉDEMMENT	E.T.C. À VENIR
(1) Project Management													2.5K		
(2) Procurement													5.1K		
(3) Machining/Fab/Assy													5.2K		
(4) In-Plant Evaluation													3.5K		
(5) Re-Certification													7.5K		
(6) Installation													2.0K		
(7) Documentation													4.0K		
PLANNED COST BY MONTH COÛT PRÉVU POUR CHAQUE MOIS	7.3K	5.2K	6.5K	5.3K	5.4K								PLAN 29.8K		
ACT. PRÉCÉN. / E.T.C. BY MONTH PRÉVISION POUR CH. MOIS														ACTUAL COÛTS RÉELS	E.T.C. À VENIR

Figure 9.1(b) Project Schedule

9.1.3 Phase III Field Trials

Task 1 Project Management

Overall project coordination, including:
- Liaison with client
- Coordination of the project team
- Contract Administration
- Budgeting and scheduling

Task 2 In-Service Evaluation Plan

- Prepare In-Service evaluation plan for approval by Client and participating carrier.

Task 3 Flight Schedule Selection

- Selection of Airports
- Selection of Flights
- Training Session (if required)
- Preparation of Testing Protocol/Forms

Task 4 Data Collection

- Collection and Logging of Raw Data
- On-site Follow-up at Periodic Intervals

Task 5 Data Processing

- Reduction of Raw Data
- Assimilation and Interpretation of Results

Task 6 Final Report

- Preparation of In-Service Evaluation Final Report
- Recommendations Regarding future potential of On-Board Storage of collapsible manual Wheelchairs

9.2 Cost Breakdown

Preliminary costs for the detailed design/construction and field trials of an in-cabin wheelchair storage device have been performed. As noted previously, these costs are for a general system. They are presented as a budgetary estimate only.

9.2.1 Phase I - Detailed Design/Cost Evaluation

Disbursements	$ 500
Labour	$23,500
	$24,000
Fee 12%	$ 2,880
FST 12%	$ 3,230
Total Estimated Phase I Cost	$30,110

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CONTRACT PLAN AND REPORT FORM – FORMULE DE PROJET DE CONTRAT ET DE RAPPORT

DSS-MAS 9143-3 (4/81)

CONTRACT TITLE – TITRE DU CONTRAT

CONTRACTOR – ENTREPRENEUR

PHASE III - FIELD TRIALS

FILE NO. – N° DU DOSSIER: N/A

SERIAL NO. – N° DE SÉRIE: N/A

TASK DESCRIPTION / DESCRIPTION DE LA TÂCHE	TASK DURATION IN MONTHS – DURÉE DE LA TÂCHE EN MOIS												TASK COST – COÛT DE LA TÂCHE		
	1	2	3	4	5	6	7	8	9	10	11	12	PLANNED PRÉVU À L'ORIGINE	ACTUAL PRÉSENTEMENT	E.T.C. À VENIR
(1) Project Management													4.0K		
(2) Field Trial Plan													1.5K		
(3) Flight Schedule Selection													1.5K		
(4) Data Collection													7.4K		
(5) Data Processing													4.2K		
(6) Final Report													5.0K		
PLANNED COST BY MONTH / COÛT PRÉVU POUR CHAQUE MOIS	2.4K	2.0K	1.6K	1.6K	1.6K	1.6K	1.6K	3.3K	5.0K	2.9K			PLAN 23.6K		
ACT. PRÉSENT. / E.T.C. BY MONTH – PRÉVISION POUR CH. MOIS														ACTUAL COÛTS RÉELS	E.T.C. À VENIR

Figure 9.1(c) Project Schedule

9.2.2 Phase II - Prototype Fabrication

Disbursements	$ 2,000
* Materials/Components	
Labour	$21,800
	$23,800
Fee 12%	$ 2,800
FST 12%	$ 3,200
Total Estimated Phase II Cost	**$29,800**

* Base C.O.B. to be provided by others.

9.2.3 Phase III - Field Trials

Disbursements	$ 500
Labour	$18,400
	$18,900
Fee 12%	$ 2,208
FST 12%	$ 2,533
Total Estimated Phase III Cost	**$23,641**

9.2.4 Total Program Cost

Phase I - Detailed Design/Cost Evaluation	$30,110
Phase II - Prototype Fabrication	$29,800
Phase III - Field Trials	$23,641
Total Estimated Program Cost	**$83,551**

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APPENDIX A

WILSHIRE AIR CHAIR

The WILSHIRE AIR CHAIR

Introducing a safe and efficient way to transport the disabled passenger:

The lightweight, portable Wilshire Air Chair has been carefully designed and constructed to make travel more comfortable and convenient for the wheelchair-bound passenger — and more efficient for those airlines, airports and hotels which serve him.

It offers ... a slender, sturdy construction designed for use in narrow aircraft aisles ... a unique rear-wheel construction for smooth maneuvering up and down steps ... plus many safety features that provide security for the passenger and the airlines between the terminal and the aircraft seat.

The Air Chair is lightweight and compact AND can easily be folded and stored between use.

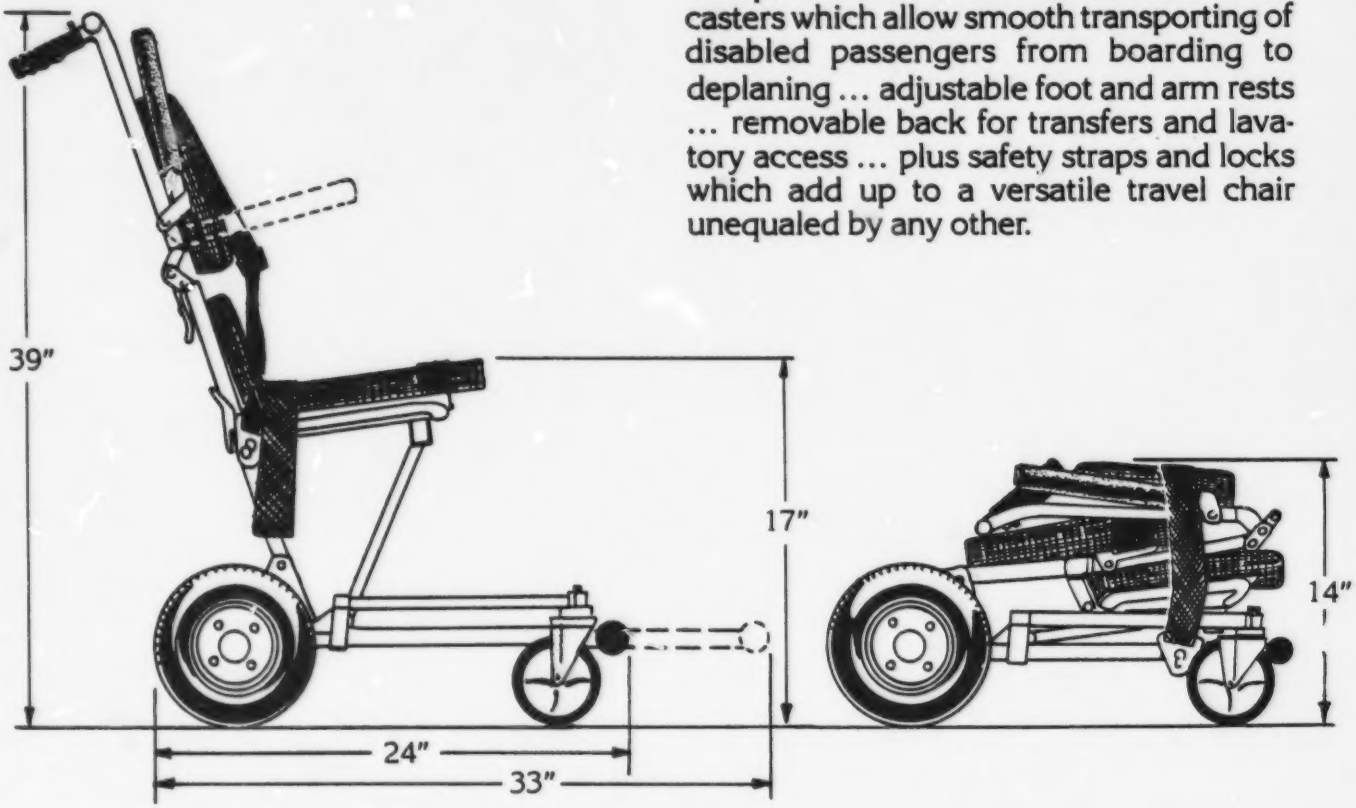
Special rear-wheel construction facilitates mounting and descending stairs

Removable seat back allows easy transfers in and out of the chair ... especially for lavatory access

From the terminal to the travel destination, a safe and sensible solution...

The WILSHIRE AIR CHAIR

The Wilshire Air Chair has many unique safety and operating features, such as ... rear pneumatic wheels and oversize front casters which allow smooth transporting of disabled passengers from boarding to deplaning ... adjustable foot and arm rests ... removable back for transfers and lavatory access ... plus safety straps and locks which add up to a versatile travel chair unequaled by any other.



Rear wheel base width: . . . .16"

Seat Height (from floor): . . .17"

Overall Length

(footrest retracted): . . .24"

(footrest extended): . . .33"

Seat width:. . . . . .14"

Overall Height:. . . . . .39"

Folded Height:. . . . . .14"

Weight:. . . . . .28 Lbs.

High density foam seat and back cushion.

ROBERT FULTON CO., PLATTS HILL RD., NEWTOWN, CT. 06470 (203) 426-9700

APPENDIX B

INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)
DANGEROUS GOODS REGULATIONS
PERTAINING TO ELECTRICAL STORAGE BATTERIES

Ref
Ser
HE9777
I61
28th, 1987

AERO
HE 777
I61

IATA

DANGEROUS GOODS REGULATIONS

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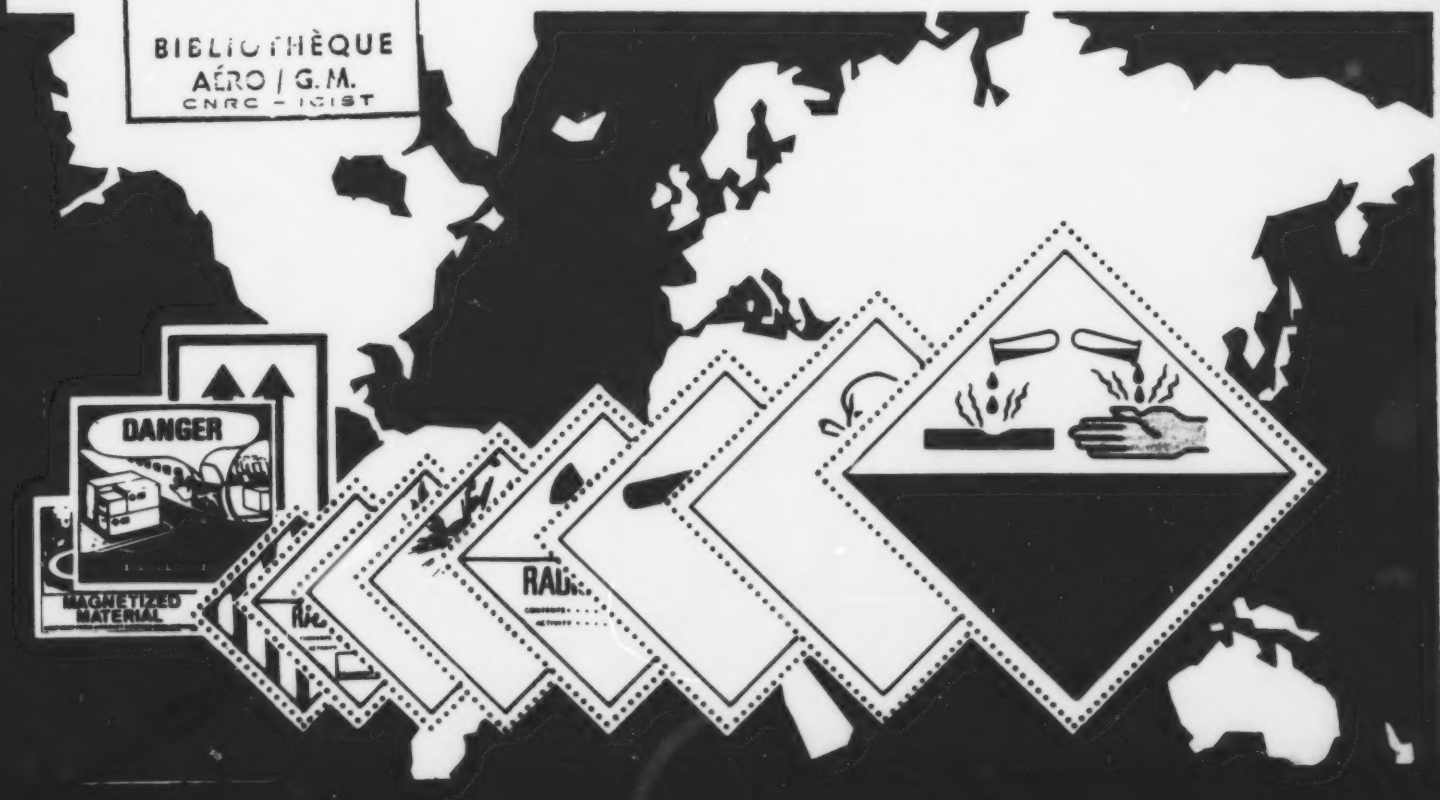


Pharmaceuticals	may contain dangerous chemicals either listed individually by name or covered by n.o.s. entries.
Photographic supplies	may contain dangerous chemicals.
Refrigerators	may contain gases or dangerous liquids.
Repair kits	may contain dangerous goods (adhesives, cellulose paints, organic peroxides, solvents, etc.)
Samples for testing	may contain dangerous goods.
Swimming pool chemicals	may contain dangerous goods.
Switches in electrical equipment or instruments	may contain mercury.
Toys	may be made of flammable material.
Vaccines	may be packed in Dry ice (solid carbon dioxide).

Note Articles and substances which do not fall within the definitions of dangerous goods as shown in these Regulations and which in the event of leakage may cause a serious clean-up problem or corrosion to aluminium on a long term basis must be checked by the shipper to at least ensure that the packaging is adequate to prevent leakage during transportation. These may include brine, powdered or liquid dyes, pickled foodstuffs, etc.

1.7. DANGEROUS GOODS EXCEPTED

△ **Exceptions for Dangerous Goods of the Operator** - STATE VARIATIONS (see sub-Section 1.8) CHG-01, USG-33

1.7.1 (a) The provisions contained in these Regulations do not apply to the following:

(1) articles and substances which would otherwise be classed as dangerous goods but which are required to be aboard the aircraft in accordance with the pertinent airworthiness requirements and operating regulations.

△ (2) alcoholic beverages, perfumes, colognes and liquified gas lighters carried aboard a passenger aircraft by the operator for use or sale on the aircraft during the flight or series of flights but excluding disposable gas lighters and those lighters liable to leak when exposed to reduced pressure.

(3) dry ice intended for use in food and beverage service aboard the aircraft.

(b) Unless otherwise authorized by the State of the Operator, articles and substances intended as replacements for those referred to in (a) above must be transported in accordance with the provisions of these Regulations, except that when consigned by operators:

(1) containers specially designed for the transport of aircraft spares and supplies may be used, provided such containers are capable of at least meeting the requirements for the packagings specified in these Regulations for the articles and substances packed in the containers; and

(2) in addition, aircraft batteries are not subject to a gross mass quantity limitation.

△ **Provisions for Dangerous Goods carried by Passengers or Crew** - OPERATOR VARIATIONS (see sub-Section 1.8) AL-06, AN-04, DA-01/02, IR-03, SK-01, TN-02, UA-03/09

1.7.2 (a) Except as otherwise provided below, dangerous goods must not be carried in or as passengers or crew checked or carry-on baggage.

Note: Security type attaché cases are totally forbidden. See entry in sub-Section 4.2, Alphabetical List of Dangerous Goods.

(b) The provisions of these Regulations do not apply to the following:

△ (1) alcoholic beverages, carried by passengers or crew as carry-on or checked baggage when packed in receptacles of less than 5 L.

Unirradiated Thorium

3.7.6. (cont) Thorium containing not more than 10^{-7} gram of uranium-233 per gram of thorium-232.

Unirradiated Uranium

Uranium containing not more than 10^{-6} gram of plutonium per gram of uranium-235 and a fission product activity of not more than 9.3 MBq (0.25 mCi) of fission products per gram of uranium-235.

Uranium — Natural, Depleted, Enriched

Natural Uranium: chemically separated uranium with the naturally occurring distribution of uranium isotopes (approximately 99.28% uranium-238, 0.72% uranium-235).

Depleted Uranium: uranium containing less than 0.72% uranium-235, with the remainder being uranium-238.

Enriched Uranium: uranium containing more than 0.72% uranium-235, with the remainder being uranium-238.

Note In all cases, a very small amount of uranium-234 is present

3

Entries in Dangerous Goods List

3.7.7 Radioactive materials appear in the Alphabetical List of Dangerous Goods only under the following entries, and in each case reference must be made to sub-Section 5.7 for quantity limitations and packing requirements:

UN 2910	Radioactive material, excepted package, instruments
UN 2910	Radioactive material, excepted package, articles
UN 2910	Radioactive material, excepted package, limited quantity of material
UN 2910	Radioactive material, excepted package, articles manufactured from natural uranium
UN 2910	Radioactive material, excepted package, articles manufactured from depleted uranium
UN 2910	Radioactive material, excepted package, articles manufactured from natural thorium
UN 2910	Radioactive material, excepted package, empty packaging
UN 2918	Radioactive material, fissile, n.o.s.
UN 2912	Radioactive material, low specific activity (LSA), n.o.s.
UN 2982	Radioactive material, n.o.s.
UN 2974	Radioactive material, special form, n.o.s.
UN 2975	Thorium metal, pyrophoric
UN 2976	Thorium nitrate, solid
UN 2977	Uranium hexafluoride, fissile, containing more than 1.0% U-235
UN 2978	Uranium hexafluoride, low specific activity, fissile excepted or non-fissile
UN 2979	Uranium metal, pyrophoric
UN 2980	Uranyl nitrate hexahydrate solution
UN 2981	Uranyl nitrate, solid

3.8. CLASS 8 — CORROSIVES

Definition of Class 8 Dangerous Goods

3.8.1. Substances which, in the event of leakage, can cause severe damage by chemical action when in contact with living tissue or can materially damage other freight or the means of transport are included in Class 8.

Packing Group Criteria

3.8.2. Assignment of substances in Class 8 to the packing groups referred to in 3.0.6 and 3.0.7 has been on the basis of experience, taking into account such additional factors as inhalation risk and reactivity with water (including the formation of hazardous decomposition products). Novel substances, including mixtures, can be judged by the length of time of contact necessary to produce visible necrosis in human skin as indicated by the test used. Such times may be determined by a suitable test based on the use of a potentially corrosive substance being applied directly to animal intact skin. The test criteria for the three packing groups in this Class are:

Packing Group I (substances presenting great danger)

Substances that cause visible necrosis of the skin tissue at the site of contact when tested on the intact skin of an animal for a period of not more than three minutes:

Packing Group II (substances presenting medium danger)

Substances that cause visible necrosis of the skin tissue at the site of contact when tested on the intact skin of an animal for a period of more than 3 but not more than 60 minutes;

Packing Group III (substances presenting minor danger) — any one of the following

(a) Substances that cause visible necrosis of the skin tissue at the site of contact when tested on the intact skin of an animal for a period of not more than four hours.

Δ (b) Substances with a corrosion rate on steel or aluminium surfaces exceeding 6.25 mm (0.25 in.) a year at a test temperature of 55°C (130°F). For the purposes of testing steel, type P_3 (ISO/2604/IV) or a similar type must be used; for the purposes of testing aluminium, non-clad types 7075-T6 or AZ5GU-T6 must be used.

3.9. CLASS 9 — MISCELLANEOUS DANGEROUS GOODS

Definition of Class 9 Dangerous Goods

Δ 3.9.1 This class comprises substances and articles which during air transport present a danger not covered by other classes.

These include:

Magnetized material — any material which, when packed for air transport, has a magnetic field strength of 0.159 A/m (0.002 gauss) or more at a distance of 2.1 m (7 ft.) from any point on the surface of the assembled package (see also Packing Instruction 902, which includes methods of determining magnetic field strength).

Other regulated substances — any material which has anaesthetic, noxious or other similar properties which could cause extreme annoyance or discomfort to a flight crew member so as to prevent the correct performance of assigned duties.

This class also includes:

Asbestos	Polystyrene beads
Dry ice	Self-propelled vehicles
Life-saving devices	Wheelchair, electric
Machines incorporating internal combustion engines	Zinc dithionite

3.10. CLASSIFICATION OF ARTICLES AND SUBSTANCES WITH MULTIPLE HAZARDS

3.10.1 Where an article or substance is not specifically listed by name in the Alphabetical List of Dangerous Goods and there are two hazards of Classes 3 and 8 and Divisions 4.1 and 6.1 associated with its air transport in that it meets the definition for two of those classes shown in sub-Sections 3.1 to 3.9, it must be classified in accordance with the Precedence of Hazards Table 3.10.A. The packing group of each of the hazards associated with an article or substance must be determined by reference to the criteria given for each of the classes or divisions concerned.

3.10.2 The Precedence of Hazards Table 3.10.A indicates which of two hazards must be regarded as the primary hazard. The class or division which appears at the intersection of the relevant line and column is the primary hazard and the other class or division is the subsidiary hazard. The most stringent packing group based on the different hazards of a material must then be the packing group for the article or substance and this is shown next to the primary hazard at the intersection of the relevant line and column.

3.10.3 Except for pesticides, where an article or substance has more than one hazard, one of which is of minor danger (Packing Group III) in Division 6.1, this hazard need not be considered in determining the classification of the article or substance.

3.10.4 The proper shipping name of an article or substance, when classified in accordance with 3.10.1 and 3.10.2, must be the most appropriate n.o.s. entry in the Alphabetical List of Dangerous Goods for the class or division shown as the primary hazard.

3.10.5 Articles or substances which meet, among other hazards, the criteria for any of the Classes 1, 2 and 7 or Division 5.2 or 6.2, except as provided in 3.10.7 and 3.10.9, are not included in Table 3.10.A since these classes and divisions always take precedence.

3.10.6 Where an article or substance not specifically listed by name in the Alphabetical List of Dangerous Goods, has:

(a) hazards in Divisions 4.2, 4.3 or 5.1, or

(b) three or more hazards,

it is not covered by the Precedence of Hazards Table (Table 3.10.A) and the advice of the appropriate authority of the state of origin must be sought.

For articles or substances meeting the definition of Division 4.1, the advice of the appropriate authority of the State of origin must be sought for the assignment of the Packing Group (I, II or III) pertaining to the Division 4.1 characteristics of the article or substance.

	UN or ID No.	Name and Description	Class or Division	Subsidiary Risk	Label(s)	Pkg Group	PASSENGER AIRCRAFT Pkg Instr	PASSENGER AIRCRAFT Max Net Qty/ Pkge	CARGO AIRCRAFT ONLY Pkg Instr	CARGO AIRCRAFT ONLY Max Net Qty/ Pkge	Special Provisions see sub-Sect 4.5
	A	B	C	D	E	F	G	H	J	K	L
	1400	**Barium**	4.3		Dangerous when wet	II II	415 *T400*	15 kg *12 kg*	417	50 kg	
	1399	**Barium alloys**	4.3		Dangerous when wet	II II	415 *T400*	15 kg *12 kg*	417	50 kg	
	1854	**Barium alloys, pyrophoric**	4.2				Forbidden		Forbidden		A2
	0224	**Barium azide,** dry or wetted with less than 50% water, by weight	1.1A	6.1			Forbidden		Forbidden		
4	Δ 1571	**Barium azide, wetted** with not less than 50% water, by weight	4.1	6.1	Flammable solid & Poison	I	Forbidden		416	0.5 kg	
B		Barium binoxide, see **Barium peroxide**									
	2719	**Barium bromate**	5.1	6.1	Oxidizer & Poison	II II	508 *T500*	5 kg *5 kg*	511	25 kg	
	1445	**Barium chlorate**	5.1	6.1	Oxidizer & Poison	II II	509 *T500*	5 kg *5 kg*	512	25 kg	
	1564	**Barium compounds, n.o.s.**	6.1		Poison Poison Keep away from food	I II II III III	606 613 *T650* 619 *T692*	5 kg 25 kg *25 kg* 100 kg *100 kg*	607 615 619	50 kg 100 kg 200 kg	A5
	1565	**Barium cyanide**	6.1		Poison	I I	606 *T651*	5 kg *5 kg*	607	50 kg	
		Barium dioxide, see **Barium peroxide**									
	2741	**Barium hypochlorite** with more than 22% available chlorine	5.1		Oxidizer	II II	509 *T500*	5 kg *5 kg*	512	25 kg	
	1446	**Barium nitrate**	5.1	6.1	Oxidizer & Poison	II II	508 *T500*	5 kg *5 kg*	511	25 kg	
	1884	**Barium oxide**	6.1		Keep away from food	III III	619 *T693*	100 kg *12 kg*	619	200 kg	
	1447	**Barium perchlorate**	5.1	6.1	Oxidizer & Poison	II II	508 *T500*	5 kg *5 kg*	511	25 kg	
	1448	**Barium permanganate**	5.1	6.1	Oxidizer & Poison	II II	508 *T500*	5 kg *5 kg*	511	25 kg	
	1449	**Barium peroxide**	5.1	6.1	Oxidizer & Poison	II II	509 *T500*	5 kg *5 kg*	512	25 kg	
		Barium selenate, see **Selenates** or **Selenites**									
		Barium selenite, see **Selenates** or **Selenites**									
		Barium Sulfate					Not Restricted		Not Restricted		
		Barium superoxide, see **Barium peroxide**									
Δ	3028	**Batteries, dry, containing potassium hydroxide,** solid, electric storage †	8		Corrosive	III	802	25 kg G	802	230 kg G	
Δ	2794	**Batteries, wet, filled with acid,** electric storage †	8		Corrosive	III	800	25 kg G	800	No Limit	

For Explanation of Abbreviations and Reference Marks, see sub-Section 2.2.

	UN or ID No	Name and Description	Class or Division	Subsidiary Risk	Label(s)	Pkg Group	PASSENGER AIRCRAFT Pkg Instr	PASSENGER AIRCRAFT Max Net Qty/ Pkge	CARGO AIRCRAFT ONLY Pkg Instr	CARGO AIRCRAFT ONLY Max Net Qty/ Pkge	Special Provisions see sub-Sect 4.5
	A	B	C	D	F	E	G	H	J	K	K
Δ	2795	**Batteries, wet, filled with alkali**, electric storage †	8		Corrosive	III	800	25 kg G	800	No Limit	
		Batteries, wet, without electrolyte †					Not Restricted		Not Restricted		
	2800	**Batteries, wet, non-spillable**, electric storage	8		Corrosive	III III	800 *T802*	No Limit *No Limit*	800	No Limit	A67
	2796	**Battery fluid, acid**	8		Corrosive	II II	809 *T800*	1 L *1 L*	813	30 L	
Δ	2797	**Battery fluid, alkali**	8		Corrosive	II II	809 *T800*	1 L *1 L*	813	30 L	
		Battery lithium type, see **Lithium batteries**									
		Benzal chloride, see **Benzylidene chloride**									
	1114	**Benzene**	3		Flammable liquid	I II	305 *T300*	5 L *1 L*	307	60 L	
		Benzene diazonium chloride (dry)					Forbidden		Forbidden		
		Benzene diazonium nitrate (dry)					Forbidden		Forbidden		
		1,4-Benzenediol, see **Hydroquinone**									
	2971	**Benzene-1, 3-disulphohydrazide**, not more than 52% as a paste	4.1		Flammable solid	II II	423 *T400*	15 kg *5 kg*	418	50 kg	
		Benzene-1, 3-disulphohydrazide, more than 52% as a paste					Forbidden		Forbidden		
		Benzene phosphorus dichloride, see **Phenyl phosphorus dichloride**									
		Benzene phosphorus thiodichloride, see **Phenyl phosphorus thiodichloride**									
	2970	**Benzene sulphohydrazide**	4.1		Flammable solid	II II	423 *T400*	15 kg *5 kg*	418	50 kg	
	2225	**Benzene sulphonyl chloride**	8		Corrosive	III III	818 *T800*	5 L *1 L*	820	60 L	
		Benzenethiol, see **Phenyl mercaptan**									
		Benzene triozonide					Forbidden		Forbidden		
	1885	**Benzidine**	6.1		Poison	II II	613 *T650*	25 kg *25 kg*	615	100 kg	
	2770	**Benzoic derivative pesticides, liquid, flammable, toxic, n.o.s.**, flash point less than 23° C	3	6.1	Flammable liquid & Poison	I II	Forbidden 305	1 L	303 307	30 L 60 L	A68
	3003	**Benzoic derivative pesticides, liquid, toxic, flammable, n.o.s.**, flash point 23°C or more	6.1	3	Poison Poison Keep away from food	I II III	603 609 611	1 L 5 L 60 L	604 611 618	30 L 60 L 220 L	A4 A6
	3004	**Benzoic derivative pesticides, liquid, toxic, n.o.s.**	6.1		Poison Poison Keep away from food	I II II III III	603 609 *T600* 611 *T692*	1 L 5 L *1 L* 60 L *60 L*	604 611 618	30 L 60 L 220 L	A4 A6

4 B

4.4. EXPLANATION OF TERMS RELATING TO DANGEROUS GOODS

ALUMINIUM DROSS is the material, usually of oxide nature, rising to the surface of impure molten aluminium metal.

ALUMINIUM, POWDER The unpolished powder may evolve hydrogen in contact with water, and finely divided dust may be ignited by naked lights or sparks. Polished aluminium powders which have been treated with oils or wax for printing or paint purposes are not generally dangerous.

AMMUNITION, ILLUMINATING Ammunition designed to produce a single source of intense light for lighting up an area. It includes:

- Bombs, illuminating and bombs, target identification
- Cartridges, illuminating and projectiles, illuminating
- Flares, aerial
- Grenades, illuminating

but includes neither cartridges, signal nor flares, surface.

AMMUNITION, PRACTICE Practice ammunition does not carry the main bursting charge but will normally include a propelling charge, explosive train and a burster.

AMMUNITION, PROOF Ammunition used to test the performance or strength of new ammunition or weapon components or assemblies.

AMMUNITION, SA (SMALL ARMS) Cartridges designed to be fired in arms, including machine guns, of calibre not larger than 19.1 mm. Except in the case of blank cartridges, they consist of a cartridge case, fitted with a primer, containing a propellant powder charge together with a projectile which may be solid, tracer, lachrymatory or incendiary. They may be arranged in boxes, mounted on belts or placed in clips. Blank cartridges and those with inert projectiles are listed under "Cartridges for weapons." Incendiary and tear-producing cartridges are listed under "Ammunition, incendiary" and "Ammunition, tear-producing" respectively. The term "Cartridges, safety" applies to any of these cartridges when they have been assigned properly the classification code 1.4S on the basis of an assessment of the potential hazard during transport.

AMMUNITION, SMOKE; AMMUNITION, INCENDIARY; AMMUNITION, TEAR-PRODUCING; AMMUNITION, TOXIC All kinds of bombs, grenades, rockets, projectiles or other devices containing incendiary, smoke, tear-producing or toxic agents. They also contain one or more of the following:

- A burster,
- An expelling charge,
- An explosive igniting device, or
- A propellant charge,

unless the agent or chemical substance is itself an explosive.

Depending on its nature or the method of packing, this ammunition presents either a risk of explosion or a fire risk. Because of subsidiary risks, this ammunition is grouped as follows:

- Ammunition, incendiary
- Ammunition, smoke
- Ammunition, tear-producing
- Ammunition, toxic

ANTIMONY TRICHLORIDE is a solid material which, upon exposure to air, rapidly absorbs moisture, so that its effect, in the event of leakage from a package would be the same as a solution.

Δ *ARSENICAL DUST (ARSENICAL FLUE DUST)* consists of smelter dust containing large proportions of arsenic. These dusts are hazardous due to their poisonous characteristics.

ARTICLES, PYROPHORIC Articles which may contain both an explosive substance or component and a pyrophoric substance (one which is capable of spontaneous ignition when exposed to air). This definition is not intended to include articles containing white phosphorus.

ARTICLES, PYROTECHNIC Articles which contain pyrotechnical substances and are used for technical purposes such as heat generation, gas generation, theatrical effects, etc.

Note: Ammunition, cartridges, power devices, signal devices and alarm devices which contain pyrotechnic substances are listed separately.

ASBESTOS is a generic name for naturally occurring mineral silicate fibres of the Serpentine and Amphibole series. In the Serpentine series is Chrysotile, commonly known as white asbestos. In the Amphibole series are Actinolite, Amosite or Mysorite (commonly known as brown asbestos), Anthophyllite, Crocidolite (commonly known as blue asbestos) and Tremolite. All types of asbestos can be hazardous to health, blue and brown asbestos being the more dangerous types.

BATTERIES, DRY are sealed, non-vented batteries of the type used in flashlights or for the operation of small apparatus. They contain zinc salts and other solids, or may be of the nickel cadmium type or other combinations of metals.

Δ *BATTERIES, DRY, CONTAINING SOLID POTASSIUM HYDROXIDE* Storage batteries filled with potassium hydroxide, solid which are shipped from the factory in their original dry state and filled with the dry alkali. Water would be added to the battery before first being used.

BATTERIES, WET, ELECTRIC STORAGE consist of series of metal plates immersed in an electrolyte. The electrolyte is a dilute sulphuric acid, but for a certain type of battery the electrolyte is a solution of potassium hydroxide. Both of these electrolytes are corrosive liquids. The casing for the acid containing batteries is commonly plastic. Storage batteries of either of these types, when containing electrolyte, are classed as corrosive liquids. Storage batteries in transit may cause damage by leakage of the electrolyte or may produce fire by accidental short circuiting of the terminals. Non-spillable batteries are designed and constructed so as to positively prevent leakage of the electrolyte, irrespective of the position of the battery. This is achieved by the use of jelly type electrolyte or porous absorbent separators or by specially designed filling and venting devices.

BATTERIES, WET, WITHOUT ELECTROLYTE are usually wet type batteries which have been shipped from the factory in their original dry state with the intent that electrolyte would be added just before placing the batteries in service. They may also be wet batteries from which the electrolyte has been removed. In this latter instance the cells should be thoroughly flushed with water and allowed to drain before shipping.

BLACK POWDER is the oldest and most widely known explosive material. Black powder is a mixture of charcoal, sodium or potassium nitrate, with or without sulphur, and is made in several grain or particle sizes, also, some black powder grains are glazed while others are not.

Black powder may be readily ignited by a spark. The finer the grains the easier the powder may be ignited. It is the peculiar susceptibility to sparks which renders the transportation of black powder hazardous.

BLUE or BROWN ASBESTOS — see ASBESTOS

BOMBS, PHOTO-FLASH Explosive articles dropped from aircraft to provide brief, intense illumination for photography.

BOOSTER Articles containing a detonating explosive and used to increase the initiating power of detonators or detonating cord.

5.8. PACKING INSTRUCTIONS — CLASS 8 — CORROSIVES

800

OPERATOR VARIATIONS (see sub-Section 1.8) EA-05, FL-06, IC-07, PI-01, RC-04, TW-08, WA-08

When UN/ICAO packagings are used, the 'Standard' UN/ICAO General Packing Requirements of 5.0.8 through 5.0.23 must also be met. Packagings must meet Packing Group II performance standards.

When IATA, Canada or USA permitted packagings are used, including specification packagings not listed herein, the 'Transitional' General Packing Requirements of 5.0.33 through 5.0.40 must also be met.

Batteries must be packed in:

Outer Packagings			
Description	UN/ICAO	IATA	Canada or USA
Wooden box	4C1 4C2	T4A	15A 15B
Plywood box	4D	T4B	15P 19A 19B
Fibreboard box	4G	T5A	12A 12B
Reconstituted wood box	4F	–	–
Plywood drum	1D	T4E	22A 22B
Fibre drum	1G	T5F	21C

Δ and shall incorporate an acidproof liner of sufficient strength and adequately sealed to positively preclude leakage in the event of spillage. The batteries must be packed so the fill openings and vents, if any, are upward, they are incapable of short-circuiting and they are securely cushioned in the packagings. The upright position of the package must be indicated on it by the 'Package Orientation' label shown in 7.3.23 and 7.3.24. The words 'This Side Up' or 'This End Up' may also be displayed on the top of the package.

If batteries are shipped as an integral component of assembled equipment, they must be securely installed and fastened in an upright position and protected against contact with other articles so as to prevent short circuits.

Batteries shall be removed and packed according to this Packing Instruction if the assembled equipment is likely to be carried in other than an upright position.

For batteries, electric storage, packed with battery fluid in the same outer packaging, see UN 2796 and 2797.

Batteries can be classified as non-spillable provided that they are protected against short circuits, are securely packaged and are capable of withstanding the vibration and pressure differential tests given below, without leakage of battery fluid.

Vibration test The battery is rigidly clamped to the platform of a vibration machine and a simple harmonic motion having an amplitude of 0.8 mm (0.032 in.) (1.6 mm (0.063 in.) maximum total excursion) is applied. The frequency is varied at the rate of 1 Hz/min between the limits of 10 Hz to 55 Hz. The entire range of frequencies and return is traversed in 95 ± 5 minutes for each mounting position (direction of vibration) of the battery. The battery must be tested in three mutually perpendicular positions (to include testing with fill openings and vents, if any, in an inverted position) for equal time periods.

Pressure differential test Following the vibration test, the battery is stored for six hours at 24°C ± 4°C (75°F ± 9°F) while subjected to a pressure differential of at least 88 kPa. The battery must be tested in three mutually perpendicular positions (to include testing with fill openings and vents, if any, in an inverted position) for at least six hours in each position.

Note *Non-spillable type batteries which are an integral part of and necessary for the operation of mechanical or electronic equipment are exempt from the requirements of this packing instruction provided they are securely fastened in the battery holder on the equipment and protected in such a manner as to prevent damage and short circuits.*

801

OPERATOR VARIATIONS (see sub-Section 1.8) FL-06, IC-07, PI-01, RC-04, TW-08, WA-08

When UN/ICAO packagings are used, the 'Standard' UN/ICAO General Packing Requirements of 5.0.8 through 5.0.23 must also be met.

When IATA, Canada or USA permitted packagings are used, including specification packagings not listed herein, the 'Transitional' General Packing Requirements of 5.0.33 through 5.0.40 must also be met.

Bombs, smoke may be carried provided they are without ignition elements, bursting charges, detonating fuses or other explosive components, in:

T696

OPERATOR VARIATIONS (see sub-Section 1.8) AA-01, AL-01, CO-01, DL-02, EA-01, FL-01, IB-01, IC-06, LY-07, NW-01, PI-04/07, RC-01/03, TW-06, UA-01, WA-06

Solids, referenced to this Packing Instruction, may be carried in quantities of not more than 1/2 kg (1 lb) net weight in inner earthenware, glass, metal or compatible plastic receptacles suitably cushioned to prevent breakage and loss of content and packed in strong wooden, fibreboard or other equally strong outer packagings. Unless otherwise specified, the maximum quantity that may be packed in any one package is 12 kg (25 lb).

The 'Transitional' General Packing Requirements of 5.0.33 through 5.0.40 must also be met.

CLASS 8 — CORROSIVES

T800

Δ STATE and OPERATOR VARIATIONS (see sub-Section 1.8) AA-01, AL-01/03, CO-01, DL-02/04, EA-01/05, FL-06, IB-01, IC-07, LY-07, NW-01, PI-07, RC-01, TW-06/08, UA-01/04, USG-01, WA-06/08

Liquids, referenced to this Packing Instruction, may be carried when packed in

(a) Suitable inner earthenware, glass or rubber receptacles of not more than 1/2 L (1 pt) or 1/2 kg (1 lb) capacity and packed in a metal can

(b) Suitable inner compatible plastic receptacles of not more than 1/2 L (1 pt) or 1/2 kg (1 lb) capacity

(c) Suitable inner metal receptacles of not more than 1/2 L (1 pt) or 1/2 kg (1 lb) capacity (authorized only for liquids which are corrosive to skin tissues, but not corrosive to metal).

Note: The inner receptacles must be packed with sufficient non-combustible cushioning and absorbent material (for example kieselguhr, whiting or vermiculite) to prevent breakage and leakage. The can(s) and receptacle(s) specified in (a), (b) or (c) must be packed in a strong wooden, fibreboard or other equally strong outer packaging. The maximum amount that may be carried in any one package is 1 L (1 qt).

The 'Transitional' General Packing Requirements of 5.0.33 through 5.0.40 must also be met.

T801

Δ OPERATOR VARIATIONS (see sub-Section 1.8) AA-01, AL-01, CO-01, DL-02, EA-01, FL-06, IB-01, IC-07, NW-01, PI-01/07, RC-01/04, TW-06/08, UA-01, WA-06/08

Articles and substances, referenced to this Packing Instruction, may be carried when packed in suitable wax, plastic or lead bottles of not more than 1/2 L (1 pt) capacity with sufficient suitable non-combustible cushioning and absorbent material such as whiting (but note that kieselguhr and other siliceous materials are not acceptable), to prevent breakage and leakage, and packed in a metal canister. The canister(s) must be packed in a strong wooden, fibreboard or other equally strong outer packaging. The maximum amount that may be carried in any one package is 1 L (1 qt).

The 'Transitional' General Packing Requirements of 5.0.33 through 5.0.40 must also be met.

T802

OPERATOR VARIATIONS (see sub-Section 1.8) FL-06, IC-07, PI-01, RC-04, TW-08, WA-08

Electric storage batteries containing electrolyte (acid or alkaline) corrosive battery fluid and which are designed to be non-spillable may be carried. Batteries must be of strong construction, protected against short circuits, and securely boxed to prevent damage during transportation. In addition, where two or more batteries are packed in the same outer packaging they must be adequately cushioned.

The 'Transitional' General Packing Requirements of 5.0.33 through 5.0.40 must also be met.

Note: Non-spillable type batteries which are an integral part of and necessary for the operation of mechanical or electronic equipment are exempt from the above requirements provided they are securely fastened in the battery holder on the equipment and protected in such a manner as to prevent damage and short circuits.

6.1.21. **Fibreboard boxes:** 4G

Specifications

(a) Strong and good quality solid or double-faced corrugated fibreboard (single or multi-wall) must be used, appropriate to the capacity of the box and to its intended use. The water resistance of the outer surface must be such that the increase in mass, as determined in a test carried out over a period of 30 minutes by the Cobb method of determining water absorption, is not greater than 155 g/m² — see ISO International Standard 535 - 1976 (E). It must have proper bending qualities. Fibreboard must be cut, creased without scoring, and slotted so as to permit assembly without cracking, surface breaks or undue bending. The fluting of corrugated fibreboard must be firmly glued to the facings.

(b) The ends of boxes may have a wooden frame or be entirely of wood. Reinforcements of wooden battens may be used.

(c) Manufacturing joins in the body of boxes must be taped, lapped and glued or lapped and stitched with metal staples. Lapped joins must have an appropriate overlap. Where closing is effected by gluing or taping, a water resistant adhesive must be used.

(d) Boxes must be designed so as to provide a good fit to the contents.

(e) Maximum net mass: 400 kg (880 lb)

6.1.22. **Plastic boxes:** 4H1 — expanded plastic boxes
4H2 — solid plastic boxes

Specifications

(a) The box must be manufactured from suitable plastic material and be of adequate strength in relation to its capacity and intended use. The box must be adequately resistant to ageing and to degradation caused either by the substance contained or by ultra-violet radiation.

(b) An expanded plastic box must comprise two parts made of a moulded expanded plastic material, a bottom section containing cavities for the inner packagings and a top section covering and interlocking with the bottom section. The top and bottom sections must be designed so that the inner packagings fit snugly. The closure cap for any inner packaging must not be in contact with the inside of the top section of this box.

(c) For dispatch, an expanded plastic box must be closed with a self-adhesive tape having sufficient tensile strength to prevent the box from opening. The adhesive tape must be weather resistant and its adhesive compatible with the expanded plastic material of the box. Other closing devices at least equally effective may be used.

(d) For solid plastic boxes, protection against ultra-violet radiation, if required, must be provided by the addition of carbon black or other suitable pigments or inhibitors. These additives must be compatible with the contents and remain effective throughout the life of the box. Where use is made of carbon black, pigments or inhibitors other than those used in the manufacture of the tested design type, retesting may be waived if the carbon black content does not exceed 2% by mass or if the pigment content does not exceed 3% by mass; the content of inhibitors of ultra-violet radiation is not limited.

(e) Additives serving purposes other than protection against ultra-violet radiation may be included in the composition of the plastic material provided that they do not adversely affect the chemical or physical properties of the material of the box. Under such circumstances retesting may be waived.

(f) Solid plastic boxes must have closure devices made of a suitable material, of adequate strength and so designed as to prevent the box from unintentional opening.

(g) Maximum net mass of a 4H1 box: 60 kg (130 lb).
Maximum net mass of a 4H2 box: 400 kg (880 lb).

6.1.23. **Steel or aluminium boxes:** 4A1 — steel
4A2 — steel, with inner liner or coating
4B1 — aluminium
4B2 — aluminium, with inner liner or coating

Specifications

(a) The strength of the metal and the construction of the box must be appropriate to the capacity of the box and to its intended use.

(b) 4A2 and 4B2 boxes must be lined with fibreboard or felt packing pieces as required or have an inner liner or coating of suitable material. If a double seamed metal liner is used, steps must be taken to prevent the ingress of substances, particularly explosives, into the recesses of the seams.

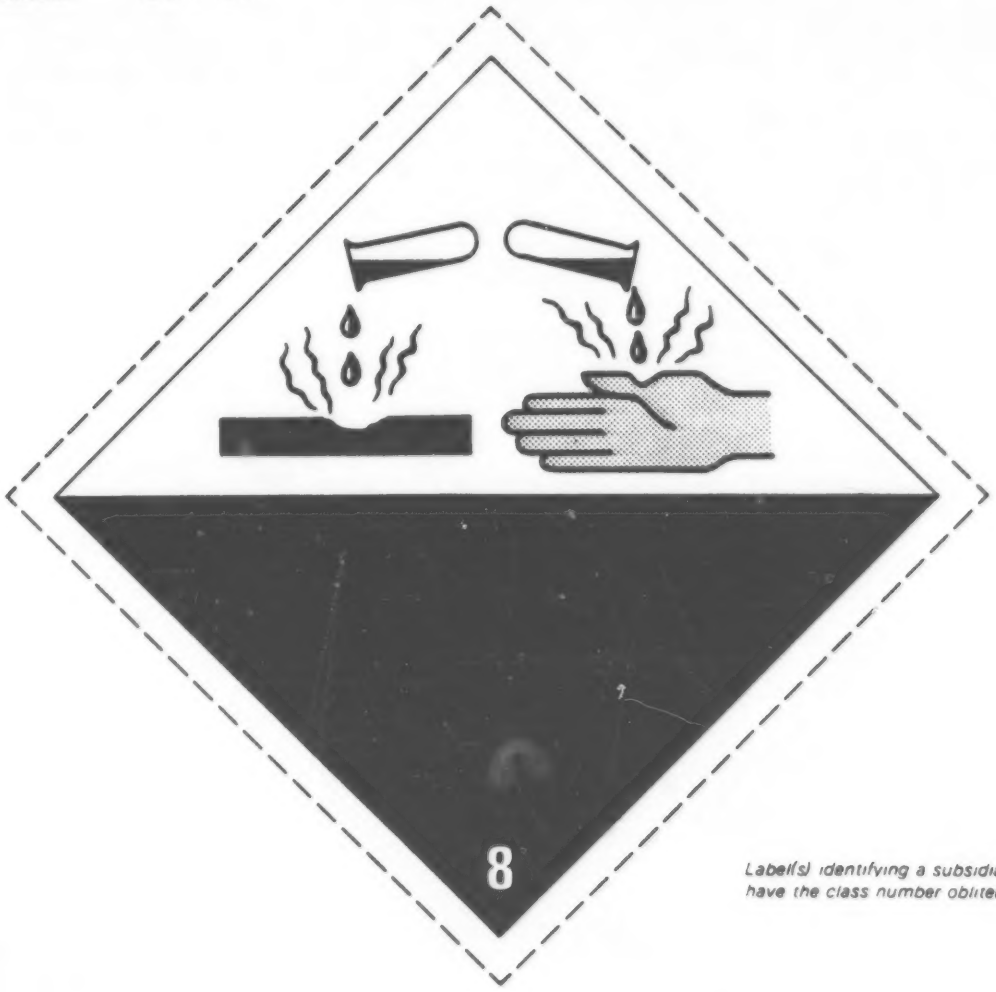
(c) Closures may be of any suitable type, they must remain secured under normal conditions of transport.

(d) Maximum net mass: 400 kg (880 lb).

7.3.20. Hazard Label for Class 8 — Corrosives

STATE and OPERATOR VARIATIONS (see sub-Section 1.8) AN-02, AUG-03, IC-09, NF-03, NZG-02, PX-02, QF-02, SQ-02

Name: Corrosive
Cargo Imp Code: RCM
Minimum dimensions: 10 cm x 10 cm



Label(s) identifying a subsidiary risk must have the class number obliterated

9.3. STORAGE

Storage of Radioactive Materials

Limitation of Exposure of Persons to Radiation

9.3.1 The radiation exposure of storage personnel must be as low as reasonably achievable and must be so controlled that no person is likely to receive a radiation dose greater than that permitted for members of the public.

Storage

9.3.2 The number of Category II-Yellow and Category III-Yellow packages, overpacks and freight containers stored in any one location must be so limited that the total sum of the transport indexes in any individual group of such packages, overpacks or freight containers does not exceed 50. Groups of such packages, overpacks and freight containers must be stored so as to maintain a spacing of at least 6 m (20 ft) from other groups of such packages, overpacks or freight containers.

9.3.3 Except in the case of Fissile Class II or Fissile Class III packages, the limitations in 9.3.2 above do not apply to packages marked "RADIOACTIVE LLS" and containing low-level solid radioactive material under 5.7.64 and 5.7.65, or those marked "RADIOACTIVE LSA" and containing low specific activity material under 5.7.66(2) or 5.7.67, when they are maintained in a compact stack of packages or in freight containers.

9.3.4 Mixing of different kinds of packages, including Fissile Class I packages with Fissile Class II packages, is permitted.

Storage of Organic Peroxides and Self-Reacting Substances

△ 9.3.5 During the course of transport, packages or unit load devices containing self-reactive substances of Division 4.1 or organic peroxides of Division 5.2 must be shaded from direct sunlight and stored away from all sources of heat in a well ventilated area. See 1.3.4 and 9.2.5 for conditions of acceptance.

9.4. LOADING

△ **Loading Restrictions on Flight Deck and for Passenger Aircraft** - STATE and OPERATOR VARIATIONS (see sub-Section 1.8) AL-07, JPG-10, NZG-06, SUG-01, SV-04/05, UA-01, USG-18

9.4.1 Dangerous goods must not be carried in an aircraft cabin occupied by passengers or on the flight deck of an aircraft, except as permitted by 1.7.1 (a) and 1.7.2 (b) and for excepted radioactive materials (see 5.7.26 through 5.7.30). Dangerous goods may be carried in a main deck cargo compartment of a passenger aircraft provided that the compartment meets all the certification requirements for a Class B aircraft cargo compartment. Dangerous goods bearing the "Cargo Aircraft Only" label must not be carried on a passenger aircraft.

Incompatible Dangerous Goods - STATE and OPERATOR VARIATIONS (see sub-Section 1.8) CX-02, ITG-04/05, JPG-11

9.4.2 Packages containing dangerous goods which might react dangerously with each other must not be stowed on an aircraft next to each other or in a position that would allow interaction between them in the event of leakage. As a minimum, the following segregation must be observed. An "x" at the intersection of a row and a column indicates that packages containing these classes of dangerous goods must be segregated.

TABLE 9.4.A

Segregation of Packages

Class or Division of primary hazard	1	2	3	4.2	4.3	5	8
1	Note 1	Note 2	Note 2	Note 2	Note 2	Note 2	x
2	Note 2	–	–	–	–	–	–
3	Note 2	–	–	–	–	x	–
4.2	Note 2	–	–	–	–	x	x
4.3	Note 2	–	–	–	–	x	x
5	Note 2	–	x	x	x	–	x
8	x	–	–	x	x	x	–

Note 1 Explosives belonging to the same compatibility group may be stowed together, regardless of the division number. Explosives which do not belong to the same compatibility group must not be stowed together, whether or not they belong to the same division in the classification except that Compatibility Groups C, D and E may be stowed together. However, explosives of Division 1.4 Compatibility Group S may be stowed with other compatibility groups, except Compatibility Groups A or L.

Note 2 Explosives other than those in Division 1.4 Compatibility Group S must not be stowed together with this class or division.

APPENDIX C

NINNESCAH CARRIAGE IN THE CABIN
MAY/JUNE 1987

WHEELCHAIRS

When air carrier personnel consider carriage of handicapped passengers, they usually think only of those who use wheelchairs. Such passengers consist only of approximately 5% of all who have disabilities which can cause travel problems. For example, those with hearing and vision problems each consist of 20% of the disabled passenger load.

However, while personnel thus tend dramatically to underestimate the total load of disabled passengers, the focus on wheelchair users is understandable because of two special passenger needs in this category - equipment or manual lifting assistance in boarding, enroute, and deplaning and the carriage problems of the wheelchair, itself.

The Biggest Service Problem?

The handling of the wheelchair of a disabled passenger probably is the greatest single difficulty in the carriage of such passengers. Almost without exception wheelchairs are carried in the cargo bay of aircraft, and such carriage produces a host of special problems.

There is the question of how and when the wheelchair is taken from the passenger and processed separately for cargo, and when and how it is returned to the passenger at the end of the flight.

Proper storage in cargo is essential to avoid damage. There also must be procedures for the quick repair of any damage which the wheelchair might suffer while being carried separately.

The situation is complicated by the fact that wheelchairs are not standardized but come in all sizes and compositions, and fold or break down into many different carrying modes.

As complicated as the manual or folding-type wheelchair is to process, its problems pale in comparision with those presented in the carriage of powered wheelchairs. Such equipment is much heavier and more cumbersome to handle. Usually it must be carried in its unfolded state, and generally has components such as a control panel, drive elements, etc., which are easily damaged in transit, and difficult and expensive to repair.

Probably most troublesome of all, the powered wheelchair usually is driven by a lead-acid, 'wet-cell' battery, the carriage of which raises the issue of the hazardous nature of its contents and the resultant difficulty of proper packaging.

And over and above the problems presented in the actual carriage of such equipment is the training of personnel in the proper handling of it. Even if air carrier, airport, and ground handling personnel are properly trained in such carriage (a relative rarity), often ground handling services are contracted out, or at international destinations they necessarily must use local airport services. The training of such personnel is beyond the control of an air carrier.

In spite of the problems presented, air carriers are under increasing pressure to carry wheelchair user passengers and their equipment. When the regulations for the new Air Carrier Access Act in the United States are issued, almost certainly U.S. airlines, and those international ones which land in the United States, will be mandated to offer service without restriction.

Some airlines have worked hard at solving the above problems, and are doing a reasonably good job of wheelchair carriage. In general, however, there is confusion and spotty service. It remains one of the areas of significant customer complaint, and a source of severe personnel stress, both factors which show promise of getting worse.

When To Take The Wheelchair?

In past years there has been considerable controversy as to when airlines should take possession of the passenger folding wheelchair for preparation for cargo carriage. Many air carriers found it operationally convenient to take it early - soon after passenger arrival at the airport - in order to facilitate an orderly process of preparing it for cargo.

Passengers in general strongly have protested the early airline possession of the wheelchair, demanding that they retain the use of it as long as possible - preferably to the door of the aircraft.

The reason for such a passenger demand is the fact that the wheelchair usually is

carefully designed for individual passenger needs and comfort. Pillows and cushions often are custom-designed, and sometimes even the chair, itself. Transfer to a strange wheelchair, even for a short period can cause discomfort, distress, and physical hardship, and in more rare cases, even medical danger.

Also, many airport boarding chairs often are not passenger mobile, and when a passenger is transferred to one, he or she must rely on airport personnel, or friends, to move about. The loss of mobility, sometimes for an extended period, is distressing to wheelchair users. A necessary lavatory visit before the flight may be difficult to make, and even shopping can be proscribed.

More and more airlines have accomodated passenger desires to use their own wheelchair to the door of the aircraft. However, the arrangement has demanded special personnel training and new procedures.

The retention by the passenger of his or her own wheelchair to the door of the aircraft necessitates the need of personnel to get it quickly to cargo after the passenger leaves it.

The usual process is to wheel the empty chair back to the gate area where it is collected for cargo stowage, or manually to carry it down the airbridge or jetway steps directly to the cargo boarding area. The latter process is preferable, but can be stressful for personnel with a heavy chair, and possibly dangerous in winter with icy conditions.

The whole process also needs careful coordination with cargo loading personnel to ensure that the wheelchair is handled properly in a timely fashion.

The same coordination is needed to return the wheelchair to the door of the aircraft for passenger deplaning. If careful coordination is not present, the wheelchair may wind up in the baggage claim area (or somewhere else) necessitating a search for it by deplaning personnel, causing them extra trouble at a time of high work load, and sometimes a long delay in deplaning the passenger.

The most effective method is to have a procedure for tagging and isolating the wheelchair in cargo so that it is unloaded first and separately, and taken directly to the plane door. The quickest way is to take it back up the jetway steps. This process, however, again may involve personnel stress in carrying a possible heavy chair up the steps.

There is pressure to use the airbridge or jetway steps, as the quick availability of the passenger wheelchair at the aircraft door permits rapid passenger deplaning. While this fact will delight the passenger, it also frees the cabin for cleaning and processing for the next flight leg.

Also, placing the passenger quickly in his or her own wheelchair will increase the mobility and independence of the passenger, and reduce the attendance time needed by personnel to assist him or her.

It should be noted that wheelchair users increasingly are demanding the use of their own wheelchairs during longer airport layovers between flight legs (for the same reasons as listed above). While there is value to the airline in providing such service as the passenger becomes independently mobile and less dependent on personnel, it puts additional pressure on personnel to perform another task in retrieving the wheelchair from cargo, and returning it, at a period of high work load.

Wheelchair Damage

A continuing complaint over the years by passengers who are wheelchair users is that the wheelchair often is damaged in cargo carriage. If such damage is substantial, the passenger effectively is 'grounded' with no means even to leave the airport.

A crisis for the passenger, and for the airline automatically ensues which sometimes takes a long time to resolve. And then

resolution often is unsatisfactory for the passenger and at great time and expense for the airline.

Ninnescah has conducted interviews with frequent flyer wheelchair users for years, and claims of extensive wheelchair damage in cargo has been persistent and pervasive.

However, the American Institutes of Research of Boston are at present doing a technical paper on the problems of the carriage of mobility aids in aircraft, and have queried airlines by questionnaire as to problems. In general, airlines indicate that they perceive wheelchair damage in cargo carriage as a minimal problem.

The difference between passenger and airline perceptions in this area is dramatic and at least three explanations (or combinations of them) seem possible.

First, many instances of damage may be resolved at the gate or baggage claim area and not mentioned in standard personnel reports to management.

Second, damage which passenger wheelchairs suffer often are coped with by the passenger in some way and not reported back to the airline.

Third, the passengers and the airlines have a differing understanding of what 'extensive' damage is. Airlines may consider occasional damage as part of operations and unavoidable. The customer, however, may find a damage incident so traumatic that he or she sees the issue as a serious problem even if, in fact, such damage does not happen very often in relation to the number of flights taken.

Air Canada is one of the few airlines to address the problem directly. Accepting the fact that a certain number of wheelchairs will be damaged in shipment, or mis-routed, procedures formally have been established at all airports for the loan of a wheelchair to a stranded passenger, and for the quick repair of of a damaged chair on site.

While such incidents may be few, in absolute terms, it is a relief both for the passenger and for personnel, to have a procedure for quick solution of a problem if and when it should occur.

Some attention has been given by the industry to minimizing damage to wheelchairs in cargo. Much of it can be avoided by the proper placement of the chair in the bays where other cargo is not loaded on top of it, or shifting cargo will not crush it.

Wheelchairs should be placed upright whenever possible as they are engineered to take the major load in this position. They are much more easily damaged by forces from the side. If a chair is stored on its side in cargo, and baggage happens to be placed on top of it, numerous problems are almost certain to occur.

Transport Canada did extensive research in the early 80s on possible protective packaging to decrease wheelchair damage. The conclusion was that there are so many difficulties because of size variability, the need to store possible containers, and packaging cost, that rigid packaging seemed not feasible.

However, Transport Canada did conclude that putting the wheelchair in a simple plastic bag had benefits. It offered some damage protection in decreasing the possibility of protruding elements of the chair hooking on something and being bent or broken. Also, parts which might fall off (foot rests, etc.) would be retained in the bag and not lost.

Air Canada, in its comprehensive packaging process for batteries (see powered wheelchairs, below) also provides a plastic bag for packaging the wheelchair.

Powered Wheelchairs

Possibly nothing is more disconcerting to untrained airline personnel than to see a wheelchair passenger approaching. Not being sure of what services are needed, they can become anxious and react in inappropriate ways. A significant portion of complaints against airlines by such passengers cite improper personnel service demands.

If a passenger in a powered wheelchair approaches the confusion is compounded, and often is shared by management. Possibly in no area of passenger service is there more variability from air carrier to air carrier, and within air carriers from gate to gate, than in handling powered wheelchairs.

For each passenger handled satisfactorily, there probably is one who receives inferior service, or is refused service altogether. With the new regulations of the Air Carrier Access Act in the offing, airlines are going to be forced to give attention to this problem.

In fairness, the carriage of a powered wheelchair is a problem. Because of its function, it is built more massively, and thus is heavier and more difficult to process. Most have control panels which are easily damaged. They have gear boxes and drive belts. And as with other wheelchairs, they are not standardized, and even trained personnel may not be sure as to how to cope with design elements of specific chairs.

While manual wheelchairs usually easily are folded for carriage, such is not the case with most powered wheelchairs, and thus airlines usually carry them in an unfolded mode. Also, usually being heavy, they can be difficult to lift to the cargo bay without lifting equipment.

Once in the aircraft cargo bay, they both take up considerable space, and must be positioned so that they will not be damaged by other overlying or shifting cargo. While the preferred mode of carriage is upright on their wheels, some aircraft such as the DC-9, BAC 1-11, and BAe-146 will not take them upright, and they must be carried on their side. As both the danger of damage is greater, and the battery probably will have to receive special handling, some air carriers which use such aircraft have in the past refused to carry powered wheelchairs.

The Battery

The biggest problem in the carriage of powered wheelchairs is the battery. Usually a 12-volt, lead-acid, 'wet-cell' unit, the battery can be a safety hazard if the contents should leak.

So-called 'vented' battery caps which have valves in them which close if the battery is tipped, are not fool-proof in aircraft as they can leak if subjected to vibration or pressure changes (both present in aircraft). Non-vented caps will prevent leaking, but offer the possibility of pressure build-up in the battery, especially at high altitudes.

In spite of the potential problems, some air carriers have determined that if the wheelchair is stored upright on its wheels in cargo, vented caps installed, and all electrical connections disconnected and taped, the chair can be carried with the battery remaining in it.

There is value in carrying the battery in the chair. It does not have to be drained, or palletized, and the problems of disconnect and reassembly of the electrical connections are avoided. Such activity takes a great deal of personnel time, and if the battery is either drained or palletized, battery acid and pallet stores must be at all stations.

Also, the wiring of the battery terminals can be complicated, and personnel may make improper re-connections at destination. Not only can such inappropriate reassembly cause a chair not to be operative, and thus create passenger problems, but improper re-connections can cause a 'short-out' and damage the electrical components which can be expensive to repair, and may not be possible at the airport.

There are further problems in battery carriage. If the battery is carried in the chair (with proper precautions) and is interlined to an airline using aircraft which must carry it on its side, carriage by the interlining carrier may be refused.

Also, an increasing number of powered wheelchairs have the battery encased, with a simple plug-in, plug-out power cable. While the power, thus, easily can be disconnected, the encased battery may be more difficult to service with vented caps, if desired. An air carrier therefore might reevaluate carrying such a battery with it remaining in the chair.

On the other hand, if it is determined that the battery must be removed, and drained and/or palletized, battery encasement can make the job more difficult, and component re-connection more difficult at destination.

Again, Air Canada has developed a standard procedure for battery carriage. A cardboard box has been made available to all stations. It has a plastic interliner, and absorbent material sufficient to capture battery acid which might leak. A wheelchair battery is removed from the chair and placed undrained in the box and sealed. Palletized to remain upright, it can be shipped with the chair, and interlined without concern.

A word should be said about a special type of battery called a 'gel cell'. Containing the electrolyte in a gel solution, such a battery cannot leak, and some airlines specifically state that they only will carry such batteries for wheelchairs.

Unfortunately, gel cell batteries are not widely used, as the power output is not considered satisfactory by most powered wheelchair users. Thus, most powered chairs airlines will be asked to carry in all likelihood will have lead-acid batteries.

Computerized Wheelchairs

To compound the problem, some severely disabled passengers may use a very complex and very expensive powered wheelchair which has computerized mobility components. Such equipment can allow the occupant to control it by moving his or her head, sucking on a tube, and so on.

Such powered wheelchairs are very expensive sometimes costing $10,000 or more each, and for the most part are impossible to repair on site if damaged. Usually they have to be returned to the manufacturer. A substitute or 'loaner' chair probably will be impossible to provide.

While such expensive computerized powered wheelchairs form a very small percentage of the powered wheelchairs which airlines are asked to carry, the increasing number of severely disabled people who are traveling, and the increasing pace of technological development, seems to guarantee that airlines will be seeing increasing numbers of them in the future.

While so far no air carrier is known to

The American Institutes of Research is preparing a technical paper for the United States government on the carriage of mobility aids in aircraft, and Ninnescah is offering consultation. The material in this article, however, comes from Ninnescah's own resources, rather than the work in progress.

Anyone wishing a copy of the technical paper should write to the Architectural And Transportation Barriers Compliance Board, 330 C Street SW, Room 1010, Washington, D.C. 20202. It probably will not be available until early 1988.

have developed a procedure for carrying such computerized powered wheelchairs, it is not too early to give thought to it. It is possible that the new United States regulations will mandate the carriage of such passenger equipment. It may be that with advance notice, air carriers may consider it feasible to crate such chairs for shipment as the best guarantee against damage.

Small Commercial Passenger Aircraft

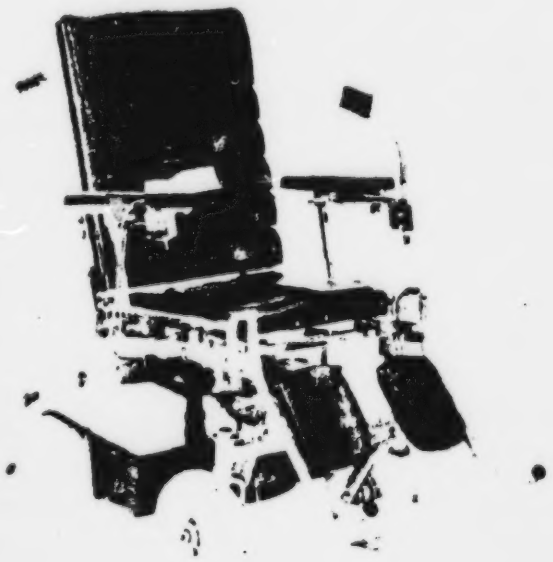
Until recently, almost no attention was given to the carriage of wheelchairs by commercial passenger aircraft under 100 seats. Operators of such aircraft have been more or less left to 'catch as catch can' on their own. As a matter of policy some airlines operating small aircraft simply did not carry such passengers, and, in fact, few requested carriage.

Suddenly and dramatically this situation has changed in the United States, with the joint-operating, 'code-sharing' agreements between regional carriers and the large airlines.

Small operators now find themselves handling the last leg of a flight of a major carrier which serves wheelchair user passengers. Such passengers arrive at regional airports often without the knowledge that the remaining leg is on a small plane. Problems are mushrooming.

A recent survey indicates that a significant number of small aircraft operators try to carry passengers who use wheelchairs. However, in general they limit such carriage to passengers with folding, manual wheelchairs. Powered wheelchairs, for the most part, are not carried.

However, except for the smallest, 9-seat aircraft, small commercial passenger aircraft can carry powered wheelchairs. Rather than carry cargo in the belly, for the most part it is carried in the aft of such aircraft, behind passenger seats. Most such areas have a door large enough, and there is sufficient space from the cargo floor to the top of the cargo hold, to take most powered wheelchairs upright.



A problem, however, is that the total cargo space is sufficiently small that the placement of a powered chair in it could take so much room that there might not be space for all the baggage of other passengers.

With the new code-sharing arrangements, regional air carriers are finding both that they are carrying larger passenger loads, and that passengers (many on longer flights) often have more baggage.

Personnel Training

Airlines have lagged in training personnel in serving disabled air passengers, and this lag also applies to the handling of mobility equipment such as wheelchairs.

However, as mentioned above, there are special problems in training personnel in the carriage of wheelchairs, as the lack of standardization of such equipment makes it difficult for even a concentrated training program to make personnel knowledgable about all designs they may meet.

Also, very important, many cargo handling services are contracted out to other companies by many air carriers, and they have little control over the training of the personnel of these contracting companies. Airlines which land at international airports often must, of necessity, rely on local airport handling services.

There are, however, some simple procedures which can reduce handling problems, especially with the more complex powered wheelchairs. One such procedure is to do as much carriage preparation as possible in the presence of the passenger.

While such a complex piece of equipment will be confusing to almost anyone not familiar with it, the passenger usually is knowledgable about its functioning as he or she must use it all the time.

Therefore, preparing it for cargo carriage in the presence of, and with the cooperation of, the passenger will tend to ensure that many serious mistakes can be avoided. The passenger may even carry special tools which are essential to the process, and know how to use them.

Conclusion

Airlines rightly see the carriage of the wheelchair as one of the most difficult aspects of handicapped passenger service. Wheelchair users agree, and complain that industry performance in this area is not good, with great variability even within airlines as to how, and if, such equipment will be carried.

The new Air Carrier Access Act of 1986, and the present development of regulations to implement it, will give emphasis to this problem, and the industry need to standardize and improve services.

However, there are serious carriage problems which still are not resolved. One is the handling of the powered wheelchair battery. While the acid in such a battery can be

contained up to a point, it still may be a possible serious hazard, and it would take only one incident in which battery acid could be identified as the culprit, for media and public hysteria to set back powered wheelchair carriage for years.

Also, the ability of smaller commercial passenger aircraft to carry wheelchairs must be ascertained, and clear guidelines developed. Both passengers and airline operators are suffering from the present confusion.

The actual incidence of damage to equipment must be ascertained, and if substantial, procedures both for minimizing it, and resolving incidents quickly and satisfactorily must be developed.

The special problems of carrying powered wheelchairs in general, and especially the complex computerized ones, need to be reviewed and procedures developed. The difficult problems of training must be addressed.

The present formal negotiations to develop the regulations of the Air Carrier Access Act offer a valuable opportunity for both passenger groups and the industry to investigate the details of many of these problems, and arrive at operational procedures which both find acceptable.●

CARRIAGE IN THE CABIN?

From time to time the proposal is made that the airline industry consider the carriage of wheelchairs in the cabin of aircraft. So far, all air carriers, even those who are sympathetic to the needs of disabled passengers, reject such proposals out-of-hand.

Airlines have strong reasons for not considering such carriage. The major one, of course, is that there is no place in the cabin to store a wheelchair. Those outside the airline industry do not realize the number of items that already must be carried in the cabin, many by law, and the difficult engineering job that it takes to find space for all of them.

There is an engineering 'domino effect' in which a new item forces something to go somewhere else, which in turn forces something to be put somewhere else, and so on. Each item move can be an engineering nightmare.

If you want to drive a cabin engineer 'bonkers' repeatedly tell him that he must find a spot for a new item, or change the location of one. It is no wonder that there is an automatic 'knee jerk' negative reaction when the possible cabin carriage of wheelchairs is mentioned.

Advantages

However, the advantages of such carriage are so great that airline management should at least look at the proposal dispassionately.

In the first place, such carriage dramatically would simplify wheelchair carriage handling. It would relieve the need for all the effort which goes into processing the chair for cargo, and from it.

It would make enplaning, and especially deplaning, much easier. Deplaning the passenger in a timely fashion both would remove a major area of customer complaint - being left in the aircraft for a long period after docking - and also more quickly free the cabin for cleaning and refurbishing for the next flight.

The alleged damage to wheelchairs which occur during cargo carriage would, for the most part be eliminated. While such elimination would be a great boon to the passenger and a reduction in repair costs, from the airline point of view a possibly large benefit would be the reduction in personnel time and stress involved in resolving such incidents.

A major coordinating problem at present, the demand of passengers to have their own wheelchairs during lay-overs or flight delays, would become a simple matter.

All-in-all a vast amount of handling problems with wheelchairs which air carriers presently experience would be removed. Also, the need to train ground crews, and especially those of contracting companies and at foreign airports, would dramatically be reduced.

Discrimination?

Airline management personnel raise another valid objection. If cabin carriage of one wheelchair could somehow be engineered, space limitations in most aircraft could not allow for more than one wheelchair in the cabin. Carriers then might face discrimination charges of allowing one passenger to have his or her chair, with all its customer advantages, in the cabin, while another 'disadvantaged' passenger gets his or her chair mangled in cargo.

However, even this problem should be able to be handled to the advantage of the airline. A single wheelchair storage space in the cabin easily should be programmable as a 'reserved item' in the airline CRS system. The single cabin wheelchair reservation space per aircraft then could be widely advertised on a 'first come-first served' basis.

Such a policy could resolve one of the major air carrier complaints about disabled passenger service - that they should book in advance to facilitate the airline being able to plan ahead to ensure the proper services. This policy has been challenged by disabled militant activists, who insist that they should be able to arrive unannounced at flight time and receive full service. Most carriers try to cooperate, even if it causes operational stresses.

However, the advantage to the customer of cabin carriage of the wheelchair is so overwhelming that most wheelchair users, if they knew of the service, would book far in advance, just to ensure reserving the cabin

carriage spot. It would be the rare militant who would forsake this advantage, just for principle.

In fact, the advantage of cabin carriage is so great for the customer that if he or she should be unable to reserve the one available space on a specific flight, there would be strong pressure for the customer to 'shop around' to find a flight where the space is available. Thus, there would be an automatic process of 'spreading the load', again reducing personnel work pressure at peak periods.

Of course, powered wheelchair users still would have to have their equipment carried in cargo. Also, when such groups as wheelchair basketball teams travel together, most wheelchairs would have to go in cargo.

However, since an estimated 80% of wheelchair user passengers use manual, folding-type equipment, and are (or would try to be) the single such passenger on a flight, airlines could afford to give much more individualized service to the remainder.

Not only would the vast majority of such passengers be delighted with the new service, but personnel would be overjoyed by its simplicity. Needless to say, handling costs per passenger also would be reduced greatly.

It might be anticipated that thoughtful disabled leaders might raise the possible objection that the many-fold reduction in the number of wheelchairs needed to be carried in cargo would retard the air carriers in focussing on the problem, and thus continuing the present confusion in that area. However, the most serious problem, the carriage of powered wheelchairs, still must be addressed and standardized carriage procedures developed, and thus the carriers are not 'let off the hook'.

The basic 'fly in the ointment' in all of this is where to put a wheelchair in the cabin. There is no cabin engineer anywhere in the world who is sitting around saying, "I've got this large empty space in the cabin and I don't know what to put in it".

However, it is also true that when air carrier managements decide that something new needs to be in the cabin, somehow room is found for it. Duty-free carts and items are only one example.

A proposal is to look at the present baggage rack already in most aircraft cabins. If a folded wheelchair could be slipped into it at the back (possibly from the side), behind a hanging plastic curtain, much of the space still would remain for cabin baggage.

Of course, the space would be reduced for other baggage. Garment bags might have to hang at an angle. Some cabin hand luggage might have to be stored at the seat, or in overhead bins. But this is the case now when there is an overflow.

The fundamental question from the airline point of view is - do the advantages outweigh the disadvantages? It is proposed that they do!●

TOPICS IN THE NEWS

AIR FRANCE HAS INFLIGHT CHAIR

NEW AIR FRANCE INFLIGHT CHAIR

Air France reports the development of a new inflight wheelchair which is being installed on all Air France B-747 aircraft. Developed with the cooperation of the Liaison Committee For the Transportation For The Handicapped (COLITRAH), the chair is being manufactured by Etablissements A. Guerin in France.

Air France also indicates that all aircraft equipped with the new chair also have movable aisle armrests to facilitate transfer of disabled passengers in and out of aircraft seats.

ACCESS TO THE SKIES CHANGES ADDRESS

The Paralyzed Veterans of America has announced the transfer of the Access To The Skies program from Rehabilitation International U.S.A. (RIUSA) to a wholly owned subsidiary of PVA called the Paralysis Society of America. The Director will be Mr. David M. Capozzi, who also is an Associate Advocacy Director of PVA.

RIUSA, an international organization in in the United States, and the U.S. affiliate

APPENDIX D

TRANSPORT CANADA AVIATION AIRWORTHINESS STANDARDS

TP6197E

Transport Canada Aviation
Transports Canada Aviation

Canada

Airworthiness Manual

AIRWORTHINESS MANUAL

CHAPTER 525

AIRWORTHINESS STANDARDS:

TRANSPORT CATEGORY

AEROPLANES

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AIRWORTHINESS STANDARDS
CHAPTER 525
TRANSPORT CATEGORY AEROPLANES

FOREWORD

GENERAL

This chapter of the airworthiness standards is based on a Part of the United States Federal Aviation Regulations (FAR). It is published in a split page format to simplify the identification of:

(1) the individual sections of the FAR,

(2) the sections of the FAR having no variations,

(3) the variations to each individual section or subsection which are editorial in nature, and

(4) additional airworthiness requirements, which are the Canadian variations based on unique operational experience and environmental conditions in Canada.

FORMAT

The FAR is presented on the left hand side of each page. On the right hand side the Canadian standards are printed with chapter, subchapters, sections and subsections numbering and heading appearing against their FAR equivalent. Where the standards are identical with the FAR, the words "No Variation" appear; where a variation exists the affected portion is printed against its FAR equivalent; and all changes are underlined.

These standards are written in the following format:

(1) **Chapter and Subchapters:**

This chapter corresponds to the equivalent Part of the FAR, bearing the same number, prefixed by a 5, and heading.

Each subchapter corresponds to the equivalent subpart of the FAR.

(2) **Sections:**

Each section corresponds to the equivalent section of the FAR, bearing the same number, prefixed by a 5, and heading.

(3) **Subsections and paragraphs:**

Subsections and paragraphs follow the numbering system of the FAR.

(4) **Appendices:**

Appendices follow the corresponding appendices of the FAR.

AIRWORTHINESS STANDARDS
CHAPTER 525
TRANSPORT CATEGORY AEROPLANES
Introduction

This chapter contains the standards of airworthiness for the design of Transport Category Aeroplanes published pursuant to subsection 211.(1) of the Air Regulations which states:

> "The Minister may cause to be published an Airworthiness Manual and an Engineering and Inspection Manual containing standards of airworthiness."

The content of this chapter is based on the Federal Aviation Regulations (U.S.), Part 25 entitled, Airworthiness Standards, Transport Category Airplanes as amended to and including amendment 25-59 published in the Federal Register dated October 26, 1984 (effective in the United States on November 26, 1984).

This chapter also contains additional airworthiness requirements which are the Canadian variants based on operational experience and environmental conditions in Canada.

(g) *Float bottom pressures.* The float bottom pressures must be established under 25.533, except that the value of K_2 in the formulae may be taken as 1.0. The angle of dead rise to be used in determining the float bottom pressures is set forth in paragraph (b) of this section.

25.537 Seawing Loads

Seawing design loads must be based on applicable test data.

Emergency Landing Conditions

25.561 General

(a) The airplane, although it may be damaged in emergency landing conditions on land or water, must be designed as prescribed in this section to protect each occupant under those conditions.

(b) The structure must be designed to give each occupant every reasonable chance of escaping serious injury in a minor crash landing when-

(1) Proper use is made of seats, belts, and all other safety design provisions;

(2) The wheels are retracted (where applicable); and

(3) The occupant experiences the following ultimate inertia forces acting separately relative to the surrounding structure:
(i) Upward- 2.0 g.
(ii) Forward- 9.0 g.
(iii) Sideward-1.5 g.

(g) *Float bottom pressures.* The float bottom pressures must be established under 525.533, except that the value of K_2 in the formulae may be taken as 1.0. The angle of dead rise to be used in determining the float bottom pressures is set forth in paragraph (b) of this section.

525.537 Seawing Loads

(No Variation)

Emergency Landing Conditions

525.561 General

(No Variation).

(iv) Downward-4.5 g, or any lesser force that will not be exceeded when the airplane absorbs the landing loads resulting from impact with an ultimate descent velocity of five f.p.s. at design landing weight.

(c) The supporting structure must be designed to restrain, under all loads up to those specified in paragraph (b) (3) of this section, each item of mass that could injure an occupant if it came loose in a minor crash landing.

25.563 Structural Ditching Provisions

Structural strength considerations of ditching provisions must be in accordance with 25.801(e).

Fatigue Evaluation

25.571 Damage-tolerance and Fatigue Evaluation of Structure

(a) *General.* An evaluation of the strength, detail design, and fabrication must show that catastrophic failure due to fatigue, corrosion, or accidental damage, will be avoided throughout the operational life of the airplane. This evaluation must be conducted in accordance with the provisions of paragraphs (b) and (e) of this section, except as specified in paragraph (c) of this section, for each part of the structure which could contribute to a catastrophic failure (such as wing, empennage, control surfaces and their systems, the fuselage,

525.563 Structural Ditching Provisions

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fitting factor prescribed in 25.625) in determining the strength of the attachment of-	ting factor prescribed in 525.625) in determining the strength of the attachment of-
(i) Each seat to the structure; and	(i) (No Variation).
(ii) Each belt or harness to the seat or structure.	(ii) (No Variation).
(j) Each flight attendant seat must be located to minimize the probability of its occupant suffering injury by being struck by items dislodged in a galley, or from a stowage compartment or serving cart. All items expected in these locations in service must be considered.	(j) (No Variation).
(k) Each forward observer's seat required by the operating rules must be shown to be suitable for use in conducting the en route inspections prescribed by 121.581(a).	(k) Each forward observer's seat required by the operating rules must be shown to be suitable for use in conducting the en route inspections prescribed by any applicable operating rule.
25.787 Stowage Compartments	**525.787 Stowage Compartments**
(a) Each compartment for the stowage of cargo, baggage, carry-on articles, and equipment (such as life rafts), and any other stowage compartment must be designed for its placarded maximum weight of contents and for the critical load distribution at the appropriate maximum load factors corresponding to the specified flight and ground load conditions, and to the emergency landing conditions of 25.561(b), except that the forces specified in the emergency landing conditions need not be applied to compartments located below, or forward, of all occupants in the airplane. If the airplane has a passenger seating configura-	(a) Each compartment for the stowage of cargo, baggage, carry-on articles, and equipment (such as life rafts), and any other stowage compartment must be designed for its placarded maximum weight of contents and for the critical load distribution at the appropriate maximum load factors corresponding to the specified flight and ground load conditions, and to the emergency landing conditions of 525.561(b), except that the forces specified in the emergency landing conditions need not be applied to compartments located below, or forward, of all occupants in the aeroplane. If the aeroplane has a passenger seating

tion, excluding pilots seats, of 10 seats or more, each stowage compartment in the passenger cabin, except for underseat and overhead compartments for passenger convenience, must be completely enclosed.

configuration, excluding pilots seats, of 10 seats or more, each stowage compartment in the passenger cabin, except for underseat and overhead compartments for passenger convenience, must be completely enclosed.

(b) There must be a means to prevent the contents in the compartments from becoming a hazard by shifting, under the loads specified in paragraph (a) of this section. For stowage compartments in the passenger and crew cabin, if the means used is a latched door, the design must take into consideration the wear and deterioration expected in service.

(b) (No Variation).

(c) If cargo compartment lamps are installed, each lamp must be installed so as to prevent contact between lamp bulb and cargo.

(c) (No Variation).

25.789 Retention of Items of Mass in Passenger and Crew Compartments and Galleys

525.789 Retention of Items of Mass in Passenger and Crew Compartments and Galleys

(a) Means must be provided to prevent each item of mass (that is part of the airplane type design) in a passenger or crew compartment or galley from becoming a hazard by shifting under the appropriate maximum load factors corresponding to the specified flight and ground load conditions, and to the emergency landing conditions of 25.561(b).

(a) Means must be provided to prevent each item of mass (that is part of the aeroplane type design) in a passenger or crew compartment or galley from becoming a hazard by shifting under the appropriate maximum load factors corresponding to the specified flight and ground load conditions, and to the emergency landing conditions of 525.561(b).

(b) Each interphone restraint system must be designed so that when subjected to the load factors specified in 25.561(b)(3), the interphone will remain in its stowed position.

(b) Each interphone restraint system must be designed so that when subjected to the load factors specified in 525.561(b)(3), the interphone will remain in its stowed position.

(6) There must be at least one hand fire extinguisher conveniently located in the pilot compartment.

(b) *Built-in fire extinguishers.* If a built-in fire extinguisher system is required-

(1) The capacity of each system, in relation to the volume of the compartment where used and the ventilation rate, must be adequate for any fire likely to occur in that compartment; and

(2) Each system must be installed so that-
(i) No extinguishing agent likely to enter personnel compartments will be hazardous to the occupants; and
(ii) No discharge of the extinguisher can cause structural damage.

25.853 Compartment Interiors

Materials (including finishes or decorative surfaces applied to the materials) used in each compartment occupied by the crew or passengers must meet the following test criteria as applicable:

(a) Interior ceiling panels, interior wall panels, partitions, galley structure, large cabinet walls, structural flooring, and materials used in the construction of stowage compartments (other than underseat stowage compartments and compartments for stowing small items such as magazines and maps) must be self-extinguishing when tested vertically in accordance with the applicable portions of Appendix F of this Part,

525.853 Compartment Interiors

Materials (including finishes or decorative surfaces applied to the materials) used in each compartment occupied by the crew or passengers must meet the following test criteria as applicable:

(a) Interior ceiling panels, interior wall panels, partitions, galley structure, large cabinet walls, structural flooring, and materials used in the construction of stowage compartments (other than underseat stowage compartments and compartments for stowing small items such as magazines and maps) must be self-extinguishing when tested vertically in accordance with the applicable portions of Appendix F of this

or other approved equivalent methods. The average burn length may not exceed six inches and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of three seconds after falling.

(b) Floor covering, textiles (including draperies and upholstery), seat cushions, padding, decorative and non-decorative coated fabrics, leather, trays and galley furnishings, electrical conduit, thermal and acoustical insulation and insulation covering, air ducting, joint and edge covering, cargo compartment liners, insulation blankets, cargo covers, and transparencies, molded and thermoformed parts, air ducting joints, and trim strips (decorative and chafing), that are constructed of materials not covered in paragraph (b-2) of this section, must be self extinguishing when tested vertically in accordance with the applicable portions of Appendix F of this Part, or other approved equivalent methods. The average burn length may not exceed 8 inches and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of 5 seconds after falling.

Chapter, or other approved equivalent methods. The average burn length may not exceed six inches and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of three seconds after falling.

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(b-1) Motion picture film must be safety film meeting the Standard Specifications for Safety Photographic Film PH 1.25 (available from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018), or an FAA approved equivalent. If the film travels through ducts, the ducts must meet the requirements of paragraph (b) of this section.

(b-2) Acrylic windows and signs, parts constructed in whole or in part of elastomeric materials, edge lighted instrument assemblies consisting of two or more instruments in a common housing, seat belts, shoulder harnesses, and cargo and baggage tiedown equipment, including containers, bins, pallets, etc., used in passenger or crew compartments, may not have an average burn rate greater than 2.5 inches per minute when tested horizontally in accordance with the applicable portions of Appendix F of this Part, or other approved equivalent methods.

(b-3) Except for electrical wire and cable insulation, and for small parts (such as knobs, handles, rollers, fasteners, clips, grommets, rub strips, pulleys, and small electrical parts) that the Administrator finds would not contribute significantly to the propagation of a fire, materials in items not specified in paragraphs (a), (b), (b-1), or (b-2) of this section may not have a burn rate greater than 4.0 inches per minute when tested horizontally in accordance with the

(b-1) Motion picture film must be safety film meeting the Standard Specifications for Safety Photographic Film PH 1.25 (available from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018), or an equivalent approved by the Minister. If the film travels through ducts, the ducts must meet the requirements of paragraph (b) of this section.

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(b-3) Except for electrical wire and cable insulation, and for small parts (such as knobs, handles, rollers, fasteners, clips, grommets, rub strips, pulleys, and small electrical parts) that the Minister finds would not contribute significantly to the propagation of a fire, materials in items not specified in paragraphs (a), (b), (b-1), or (b-2) of this section may not have a burn rate greater than 4.0 inches per minute when tested horizontally in accordance with the applicable

applicable portions of Appendix F of this Part or other approved equivalent methods.

(c) In addition to meeting the requirements of paragraph (b), seat cushions, except those on flight crew member seats, must meet the test requirements of Part II of Appendix F of this part or equivalent.

(d) If smoking is to be prohibited, there must be a placard so stating, and if smoking is to be allowed-

(1) There must be an adequate number of self-contained, removable ashtrays; and

(2) Where the crew compartment is separated from the passenger compartment, there must be at least one sign meeting the "No Smoking" sign requirements of 25.791 notifying all passengers when smoking is prohibited.

(e) Each disposal receptacle for towels, paper, or waste must be fully enclosed and constructed of at least fire restraint materials, and must contain fires likely to occur in it under normal use. The ability of the disposal receptacle to contain those fires under all probable conditions of wear, misalignment, and ventilation expected in service must be demonstrated by test. A placard containing the legible words "No Cigarette Disposal" must be located on or near each disposal receptacle door.

portions of Appendix F of this Chapter or other approved equivalent methods.

(c) In addition to meeting the requirements of paragraph (b), seat cushions, except those on flight crew member seats, must meet the test requirements of Part II of Appendix F of this Chapter or equivalent.

(d) If smoking is to be prohibited, there must be a placard so stating, and if smoking is to be allowed-

(1) (No Variation).

(2) Where the crew compartment is separated from the passenger compartment, there must be at least one sign meeting the "No Smoking" sign requirements of 525.791 notifying all passengers when smoking is prohibited.

(e) (No Variation).

(f) Lavatories must have "No Smoking" or "No Smoking in Lavatory" placards located conspicuously on each side of the entry door, and self-contained removable ashtrays located conspicuously on or near the entry side of each lavatory door, except that one ashtray may serve more than one lavatory door if the ashtray can be seen readily from the cabin side of each lavatory door served. The placards must have red letters at least one-half inch high on a white background of at least one inch high. (A "No Smoking" symbol may be included on the placard).

(f) (No Variation).

25.855 Cargo and Baggage Compartments

(a) Thermal and acoustic insulation (including coverings) and liners, used in each cargo and baggage compartment not occupied by passengers or crew, must be constructed of materials that at least meet the requirements set forth in 25.853(b).

(a-1) Class B through Class E cargo or baggage compartments as defined in 25.857, must have a liner and the liner must be constructed of materials that at least meet the requirements set forth in 25.853(b), must be separate from (but may be attached to) the airplane structure, and must be tested at a 45° angle in accordance with the applicable portions of Appendix F of this Part or other approved equivalent methods. In the course of the 45° angle test, the flame may not penetrate (pass through) the material during

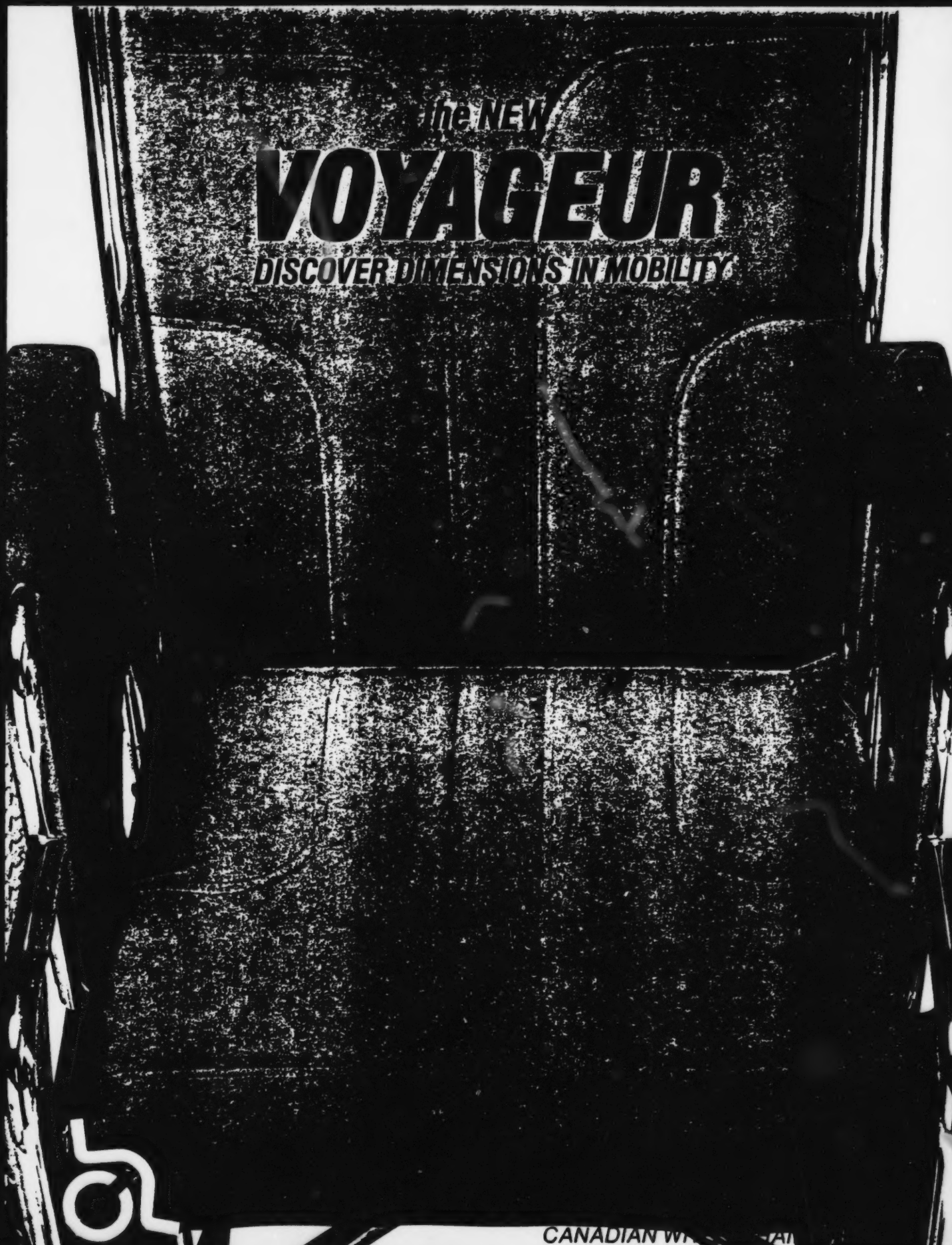
525.855 Cargo and Baggage Compartments

(a) Thermal and acoustic insulation (including coverings) and liners, used in each cargo and baggage compartment not occupied by passengers or crew, must be constructed of materials that at least meet the requirements set forth in 525.853(b).

(a-1) Class B through Class E cargo or baggage compartments as defined in 525.857, must have a liner and the liner must be constructed of materials that at least meet the requirements set forth in 525.853 (b), must be separate from (but may be attached to) the aeroplane structure, and must be tested at a 45° angle in accordance with the applicable portions of Appendix F of this Chapter or other approved equivalent methods. In the course of the 45° angle test, the flame may not penetrate (pass through) the

APPENDIX E

MANUAL WHEELCHAIR INFORMATION


the NEW
VOYAGEUR
DISCOVER DIMENSIONS IN MOBILITY
CANADIAN WH

We have spent a lot of money and energy so that you won't have to

To develop the mechanical engineering of a new generation of Voyageur chairs is only half of the challenge; creating the "environment" in which an individual can take proper advantage of the chair's capabilities is equally vital and demanding. The Human Engineering Factor is of critical concern in designing the "fit" and the dynamics which should exist between the individual and the chair.

Small adjustments to ergonomic design often go unnoticed but it is these changes which add unseen value and expand the dimensions of mobility. For example:

Item: The side panel material change from stainless steel to rugged ABS is easily noticed. As important but less apparent, the side panel has been repositioned to improve splash and clothing protection; the desk style arm now affords closer approach (an extra inch) to desk or table and weight has been reduced by eliminating material.

Item: The position of the brake lever has been modified to improve leverage and to reduce the effort required to lock and unlock the wheels.

Item: The rear wheel axle bushing angle has been altered to improve ride, cornering ability, lateral stability, and wheel propulsion position.

Item: Tall Adult models have the same overall length as standard Adult models even though the seat is 1½"/4 cm deeper. The seat is also almost 1½"/4 cm higher off the floor to augment comfort and fit.

These and other changes in design, construction and material composition are further refinements of the Standard Features described on the following page. It is the "fine tuning" however which makes Voyageur the chair that is discovering new dimensions in mobility.

STANDARD FEATURES:

1. POLYCOMP VR WHEELS

- Ultralight composite wheels developed in Sweden using the latest glass reinforced polymer technology and sectional construction.
- Sealed precision bearings to reduce propulsion effort and increase bearing life.
- Sanitary, easily cleaned, maintenance free wheels which won't rust, corrode or misalign.
- Choice of treaded or smooth pneumatic tires or the new ultralight polymer semi-pneumatic tires. "Versa Rim" interchangeability of tires allows complete flexibility in adapting POLYCOMP wheels to varying uses.
- Chrome plated steel handrims with 5 attachment positions are standard. Precision Lightweight models are equipped with lightweight polymer handrims.
- Optional Quick Release Wheel Mounting System.

2. DUPONT "SUPERTUFF" NYLON FRONT CASTERS (8" x 1")

- Sealed, prelubricated, double ball bearing system to ensure easy rolling and long life.
- Non-corrosive, sanitary, easily cleaned wheel hub.
- Improved gray rubber tire for a smoother, softer ride and increased wearability on standard weight models.
- New semi-pneumatic polymer tires with exceptional rolling capabilities on Precision Performance Lightweights.

3. PLASTIC COATED FOOTPLATES

- Decreases slippage, while maintaining footplate appearance.
- Full bumper protection reduces marring of furniture and walls.
- Warmer in appearance and less sensitive to temperature variations.

4. "SQUARE LOCK" ADJUSTABLE FOOTRESTS

- Never misalign, adjust them once and they stay put.
- Stronger than conventional round tubing to provide substantially greater accidental impact protection.
- Easy to access length adjustment with a wide choice of adjustment ranges.

5. "DELTA RELEASE" FOOTREST/LEGREST SYSTEM

- The fully enclosed contoured release mechanism prevents release malfunctions, eliminates all sharp edges and is compact and streamlined in appearance.
- Accommodates all Voyageur or Cadet model footrests so a greater range of minimum/maximum extensions is available without custom modification.
- The release lever is located on the outside of the frame to facilitate access and control. It is adjustable in height and position and even offers an optional extension.
- The release is spring loaded for automatic swing away and locking functions.

6. FRAME CONSTRUCTION

- Combines lightweight Chrome-moly (PL models only) and cold rolled steels with non-corrosive Aluminum alloy inner rails to provide well balanced lightweight durability.
- Frames are hand brazed to guarantee integrity and quality, then cleaned to ensure proper adhesion, buffed, nickel plated, cleaned again and finally electrostatically chromium plated to provide a durable, lustrous finish.
- Redesigned "front end" on all detachable arm models. By repositioning the telescope frame supports to where the weight is, the potential for telescope distortion and folding problems has been reduced while frame flexibility, balance and ride over all types of terrain has been improved.

7. ABS SIDE PANELS

- ABS is well-known for its high impact resistance, its ability to withstand temperature extremes (it's used in the Arctic and on recreational vehicles) and its resilience. Don't hesitate to throw it around but don't expect it to scratch or dent like stainless steel side panels – it won't. Moreover, it is easy to clean, has no sharp edges, doesn't collect dirt etc., and doesn't conduct heat or cold like stainless steel.

8. UREFORM ARMPAD/LEGREST PAD

- Armpads and legrest pads have been a key irritant to wheelchair users and a source of constant repair or replacement. The ureform pads are constructed of a controlled density urethane molded around a hardwood core. They are virtually indestructible in any climate or condition and more than that, retain their resilient cushioning long after conventional pads have "flattened out". The wrap around design is contoured to aid in transfer and provide comfortable non-abrasive seating and/or leg support. Colour co-ordinated with upholsteries.

9. UPHOLSTERY

- The standard upholstery is reinforced, high quality flame retardant durable vinyl, first tested and used in marine and recreational vehicle applications. Both seat and back are reinforced with a liner as well as seat belt material in critical stress areas. In addition to padding the fabric when embossing it, the upholstery is also cushioned to provide plush comfort. Notice that the seat upholstery projects right to the end of the frame and then rolls under to soften the front edge. These features protect against frame contact when transferring and reduce interference with circulation. Finally, all seat attachment hardware is out of sight to reduce moisture penetration and dirt collection as well as the discomfort of contacting metal screws.

CLOTH FABRIC UPHOLSTERY is also available as a standard equipment alternative to vinyl. Available in seven stylish colours, this flame retardant 100% acrylic pile material has been used extensively in automotive applications and offers some important and exciting advances. The fabric is extremely durable and is not susceptible to cracking or breakdown even after prolonged use. Seating comfort is enhanced because the material insulates against temperature extremes so it won't hold in the summer's heat or the winter's cold. Fabric also allows substantially better air circulation and assists in maintaining good posture because of its non-slip properties so that skin irritation and discomfort are reduced. Finally, the acrylic pile is resistant to most stains and can generally be cleaned with a mild soap. Cloth cushions ordered with this upholstery will be colour matched and will provide additional protection against slippage etc.

10. SPACE SAVER ARM

- While the Voyageur PL is also available in conventional arm styles, consider the Space Saver arm advantage. By wrapping the arm around the back of chair, the overall width of the chair is reduced by about 1¼"/3 cm compared to conventional arm chairs without reducing interior space. The narrower the chair the greater the accessability.

11. Available in Fixed or Detachable Arm Styles.

VOYAGEUR SERIES ADULT WHEELCHAIRS

ORDER CODE KEY

SERIES	CASTER SIZE	ARM TYPE	BACK TYPE	FOOT/LEGREST ASSEMBLY	SPECIAL CONSTRUCTION	CHART CODE
V - Voyageur V8 - Voyageur Magic	8 - 8"	10 - Fixed Arm **SPACESAVER** 55 - Det. Full Length 55A - Det. Desk Length 55D - Det. Adj. Height Full Length 55AD - Det. Adj. Height Desk Length 55E - Det. Sloped Sport Arm **CONVENTIONAL** 15 - Det. Full Length 15A - Det. Desk Length 15F - Det. Full - Recliner 15AF - Det. Desk - Recliner 15B - Offset Full Length (fixed) 15AB - Offset Desk Length (fixed) 15D - Det. Adj. Height Full Length 15AD - Det. Adj. Height Desk Length 15E - Det. Sloped Sport Arm	Standard (not coded) 21 - Semi reclining 27 - Full reclining 28 - Adjustable	60 - Delta Release footrest 70 - Delta Release legrest 32 - Hook-on footrest (indoor chair only) XX - No footrests	J - Junior HE - Hemi (Low Seat) AMP - Amputee OAD - One Arm Drive TA - Tall Adult AA - Low Back Adult ATA - Low Back Tall Adult D - Indoor PL Precision Performance Lightweight JPL - Junior 16" Precision Performance Lightweight HEPL - Hemi Precision Performance Lightweight AMPPL - Amputee Precision Performance Lightweight TAPL - Tall Adult Precision Performance Lightweight AAPL - Low Back Adult Precision Performance Lightweight ATAPL - Low Back Tall Adult Precision Performance Lightweight **HEAVY DUTY CONSTRUCTION** 5114 - Reinforced HD - Heavy Duty XD - Extra Heavy Duty	18 - Full Adult 17 - Medium Adult 16 - Narrow Adult 15 - Slim Adult 19 thru 24 - Extra Large Adult

IF REQUIRED, USE APPROPRIATE CONVENTIONAL ARM CODE IN LIEU OF SPACESAVER CODE - NO CHANGE IN PRICE

The Voyageur Series is available in a wide range of models and construction making it an ideal choice when prescribing wheelchairs.

The Specifications table to the right deals with "standard" models. For more detailed information, please refer to the following additional brochures dealing with the Voyageur Series: **Tall Adult Series, Hemi (Low Seat) Models, Recliners, Specialty and Custom Models.**

NOTES RE DIMENSIONAL SPECIFICATIONS:

Delta Footrest and Legrest Assemblies are interchangeable among Voyageur and Cadet models (as well as Butterfly models equipped with Delta) so that virtually any minimum-maximum range can be achieved without time consuming and costly custom modifications. Specifications have been given on standard equipment choices but any type may be chosen.

For Standard Voyageur models please note that "61" style footrests will give a range of 5½" (14 cm) – 9½" (24 cm); "62" style footrests 11" (28 cm) – 16" (41 cm); "71" style legrests 9½" (24 cm) – 15½" (39 cm) elevated maximum, and "72" style legrests 11" (28 cm) – 16" (41 cm) elevated maximum. (J-16 models subtract 1" (2 cm) from the figures above.) **What you thought was custom, probably isn't anymore.**

[1] Models with SpaceSaver Arms – reduce width by 1¼"/3 cm.
[2] L/W Models – reduce length by 1"/2.5 cm.
• Same as specification to the left.
N/A Not Applicable.

DIMENSIONAL SPECIFICATIONS

Correct at time of publication. Subject to change without notice.

	Inches/Centimeters	MODELS V815(A) 69/70 (PL) 16"	V815(A) 69/70 (PL) 16	V816 69/70 (PL) 16	V816 69/70 (PL) 16
OVERALL	WIDTH OPEN[1]	25/66	24/61	24½/62	22½/57
	WIDTH FOLDED	11½/29	•	9¾/25	•
	HEIGHT	35¾/91	•	•	•
	LENGTH[2] (Without Front Rigging)	32/81	•	•	•
SEAT	WIDTH AT SEAT LEVEL	18/46	16/41	18/46	16/41
	WIDTH BETWEEN ARMPADS	18/46	16/41	16/41	14/36
	DEPTH	16/41	•	•	•
	HEIGHT FROM FLOOR	19¾/50	•	•	•
EXTENSIONS Footrest	MINIMUM	15½/39	•	•	•
	MAXIMUM	21¼/54	•	•	•
EXTENSIONS Legrest	MINIMUM	18/46	•	•	•
	ELEVATED MAXIMUM	27/29	•	•	•
WEIGHT Standard	NO FRONT RIGGING	40½/18.3	40/18.1	38¼/16.4	35¾/16.2
	NO ARMS OR FRONT RIGGING	35¾/16.2	35¼/15.9	N/A	N/A
WEIGHT Lightweight	NO FRONT RIGGING	35¾/16.2	35¼/15.9	33¼/15	32¾/14.8
	NO ARMS OR FRONT RIGGING	31/14	30½/13.8	N/A	N/A

CANADIAN WHEELCHAIR MFG. LTD.
1360 Blundell Road
Mississauga, Ontario, Canada L4Y 1M5
(416) 275-3960

"MOBILITY BY DESIGN"

LT BY
CANADIAN WHEELCHAIR MFG. LTD.

HORIZON

STANDARD FEATURES INCLUDE

All weather, flame retardant vinyl upholstery made to Marine and RV specifications.
Padded armrest and/or legrest pads (optional UREFORM armpad and legpad).
"Reflection" chrome-plated tubular steel frame and handrims.
Protective stainless steel side panels.
Versa Rim® 24" rear wheels with 36 high tensile strength spokes and non-marking gray polymer semi-pneumatic tires.
Versa Rim® 24" wheels are built to allow universal interchangeability of tire type. All Canadian Wheelchair 24" wheels will accept either semi or full pneumatic gray tires at any time to adapt to changing needs or uses.
Hook-on footrest or optional legrest, adjustable and detachable. Both footrest and legrest can be hooked to the side to facilitate transfer.
Full support inner frame construction.
Adjustable tension wheel lock system.
Rear axles offset for increased strength and stability.
Snap-on protective hub caps and dust caps.
Sealed rear wheel bearings for longer life and easier roll.
8" molded Dupont "Super Tuff" nylon front wheel with sealed double ball bearings.
Folds to 9¾"/25 cm.
All Horizon models are available in two standard widths – 18" or 16" for adults or narrow adults.
Weighs less than 36 lbs./16.2 Kg (net).

POPULAR OPTIONS

Horizon Wheelchairs offer a number of useful optional accessories. Some are listed below but contact your Canadian Wheelchair dealer for a complete list.

ORDER CODE

1541 **WHEELCHAIR TRAY** – bracket type fastener (adjustable) with raised rubber rim to provide a working or food service surface.

1541V **WHEELCHAIR TRAY** – with Velcro fastener to enable quick transfer among numerous wheelchairs.

URE 1 **UREFORM ARMPAD** – resilient, comfortable, contoured and virtually indestructible. (For armpads and legrest pads, use code URE 2.)

2117 **CRUTCH AND CANE HOLDER** – for those who alternate between wheelchair and cane or crutch.

2119A **SAFETY BELT** – with Auto type release to provide increased security and better posture in wheelchair.

2119V **SAFETY BELT** – with Velcro closure.

2121 **I.V. POLE**

2121A **I.V. POLE** (adjustable height)

2127 **AMPUTEE ADAPTORS** – to increase wheel base and thus stability for amputees.

3111 **BRAKE LEVER EXTENSIONS** – (removeable) to increase leverage and reduce effort required to apply brakes.

3116 **FORWARD STABILIZERS** – adjustable with rubber foot to prevent forward tipping in cases where legrest is elevated to accommodate a leg in a cast or where other unusual weight imbalance has occured.

4111 **VELCRO FASTENING LEG STRAP** – to prevent feet or legs from slipping off and behind footplates.

4112 **NYLON HEEL LOOPS** – to locate foot securely on footplate.

5115 **SOLID SEAT INSERT** (padded) – to supplement standard hammock seat with a solid seating platform. Easily removed or transferred to other chairs.

5116 **SOLID FOLDING SEAT INSERT** (padded) – replaces standard hammock seat with a comfortable rigid seat which folds like the standard wheelchair.

6115T **TREADED PNEUMATIC TIRES** – on rear wheels to provide a cushioned ride with improved traction on outdoor terrain. Also available in SMOOTH PNEUMATIC (code 6115S).

6122 **24" POLYCOMP VR LIGHTWEIGHT REAR WHEELS** – equipped with polymer semi-pneumatic tires and precision sealed bearings for easier rolling and longer life. These wheels are the no maintenance, sanitary solution to wheelchair care – no spokes, no misalignment, no rusting and easily cleaned. Also available with treaded pneumatic tire (code 6122T) or smooth pneumatic tires (code 6122S).

6116 **8" x 2" SEMI PNEUMATIC FRONT WHEELS** – for use over rough outdoor terrain and freedom from flat tires.

6116P **8" x 2" PNEUMATIC FRONT WHEELS** – provide a cushioned ride over uneven terrain and are wider than the standard caster so they won't catch in ruts etc.

6117 **8" x 1¼" PNEUMATIC FRONT WHEELS** – provide a cushioned outdoor ride but are narrower and easier to operate on indoor carpeted surfaces.

6111 **PLASTIC COATED HANDRIMS** – to improve grip and facilitate propulsion.

6112 **HANDRIMS** – with 8 VERTICAL PROJECTIONS to facilitate propulsion for individuals with limited hand function or strength. Also available with HORIZONTAL or OBLIQUE PROJECTIONS (codes 6113 or 6114).

7002
7003
7004
7002N
7003N
7004N

CUSHIONS – in 3 thicknesses (2", 3" or 4") and available in cloth or vinyl coverings. Cushions provide additional seating comfort and aid in adjusting seat height from floor, arm height from seat etc. without expensive custom modification.

6130 **QUICK RELEASE AXLES** – to allow easy removal of rear wheels thereby increasing portability and reducing weight.

PHOTO GUIDE

TOP LEFT – Model H81032-18 Adult (shown) or H81032-16 Narrow adult.
BOTTOM RIGHT – Model H81033-18 Full Adult (shown) or H81033-16 Narrow Adult with optional UREFORM armrest and legrest pads and optional POLYCOMP VR wheels with precision bearing system. These options reduce or virtually eliminate most maintenance and make Horizon the ideal choice for general purpose and institutional use.

ORDER CODE KEY

SERIES	CASTER SIZE	ARM TYPE
H - Horizon	8 - 8"	10 - Fixed
BACK TYPE	**FOOT/LEGREST ASSEMBLY**	**CHAIR SIZE**
Standard (not coded)	32 - Hook-on Adjustable Footrests 33 - Hook-on Adjustable Legrests	18 - Full Adult 16 - Narrow Adult

DIMENSIONAL SPECIFICATIONS

Correct at time of publication. Subject to change without notice.

DIMENSIONAL SPECIFICATIONS Inches/Centimeters		MODELS	H81032 18 IN/CM	H81032 16 IN/CM	H81033 18 IN/CM	H81033 16 IN/CM
SEAT	WIDTH AT SEAT LEVEL		18/46	16/41	18/46	16/41
	WIDTH BETWEEN ARMPADS		16/41	14/36	16/41	14/36
	DEPTH		16/41	•	•	•
	HEIGHT FROM FLOOR		19½/50	•	•	•
EXTENSIONS	Legrest	MINIMUM	N/A	N/A	17/43	•
		ELEVATED MAXIMUM	N/A	N/A	26/66	•
	Footrest	MINIMUM	15/38	•	N/A	N/A
		MAXIMUM	21/53	•	N/A	N/A
WT.	NO FRONT RIGGING LB/Kg		35½/16.1	35/15.8	35½/16.1	35/15.8

• Same as specification to left

CANADIAN WHEELCHAIR MFG. LTD.
1360 Blundell Road
Mississauga, Ontario, Canada L4Y 1M5
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"MOBILITY BY DESIGN"

LAURENTIAN

The POPULAR PERFORMERS

Standard and lightweight construction in a broad range of styles

including Hemi (low seat) and recliner models

DESIGN/BUILT BY
CANADIAN WHEELCHAIR MFG. LTD.

A

B

THE POPULAR PERFORMERS

Available in Performance Lightweight or standard weight models, Laurentian wheelchairs are designed to meet many requirements, and to respond to varying needs. Quality constructed to provide years of reliable use, Laurentian offers as standard equipment many features usually only available on more expensive chairs.

STANDARD FEATURES INCLUDE:

- All weather, flame retardant vinyl upholstery with reinforced upper back area. The upholstery is padded, embossed and made to marine and RV specifications.
- UREFORM armpads and/or legrest pads – resilient, comfortable, contoured and virtually indestructible (colour co-ordinated with upholstery).
- Swinging detachable footrest or optional elevating legrests (both interchangeable and adjustable) with easily accessed pivot release system.
- Choice of fixed (non removable) or detachable arms in full length, desk length and adjustable height styles. Optional SPACE SAVER detachable arms (which reduce overall width of the wheelchair without affecting interior space) are also available.
- "Reflection" chrome-plated tubular steel frame and handrims.
- Protective stainless steel side panels.
- Canadian Wheelchair's Versa Rim* 24" rear wheels with 36 high tensile strength spokes and lightweight gray polymer semi-pneumatic tires.
- Versa Rim* 24" wheels are built to allow universal interchangeability of tire type. All Canadian Wheelchair 24" wheels will accept either semi or full pneumatic gray tires at any time to adapt to changing needs or uses.
- Full support inner frame construction.
- Adjustable tension wheel lock system.
- Rear axles offset for increased strength and stability.
- Snap-on hub caps and dust caps to afford further protection to bearings.
- Sealed rear wheel bearings for longer life and easier roll.
- 8" molded Dupont "Super Tuff" nylon front wheel with sealed double ball bearings.
- All Laurentian models are available in two standard widths – 18" or 16" for adults or narrow adults.

PHOTO GUIDE

FRONT PAGE – Fixed arm model L81039-18 Full Adult (shown) or L81039-16Narrow Adult. Footrests and legrests are interchangeable and also allow footplate position adjustment to provide comfortable leg support.

A **Detachable adjustable height desk length arm model L815AD39-16 Narrow Adult** (shown) or L815AD39-18 Full Adult. The advantage of detachable arm models in general is the ability to remove the arms for transfer and to increase wheelchair portability. The "desk" style detachable arm allows close approach to a table or desk without removing the arm.
Detachable adjustable height arms (optional in full or desk length styles) are easy to operate and provide an adjustment range of 5" to suit most individuals who for reasons of physical size or other factors (addition of a cushion or insert for example) can not obtain comfortable seating with the standard height arm.
The POLYCOMP VR rear wheels illustrated are optional.

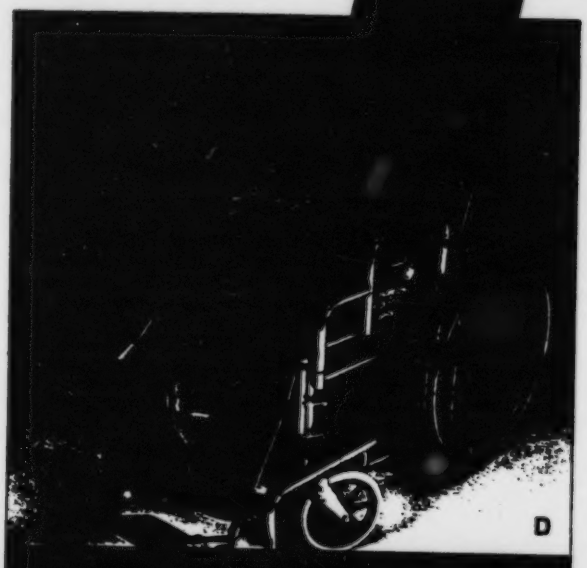
B **Hemi (Low Seat) model with Detachable full length arm; L81539HE-18 Full Adult** (shown) or L81539HE-16 Narrow Adult. Hemi models are 2"/5 cm closer to the ground making them ideal for shorter people or those wanting foot propulsion of the chair. The removeable brake lever extensions illustrated (an optional accessory on all models) increase leverage and decrease effort to apply brakes.

C **The model illustrated L815A40-17 Medium Adult** is also equipped with optional Amputee Adaptors (#2127) which increase the wheel base and stability of the chair to offset the loss of weight and balance due to amputation. Another option shown here are the Oblique Projection handrims which provide increased propulsion facility for individuals with limited hand function. Other handrims available are Horizontal or Vertical Projection handrims as well as Plastic Coated handrims which increase friction and grip between hand and handrim.

D **Reclining back models** are available in fixed or detachable arm styles. The model illustrated L815A2740-18 is an Adult size full recliner where the back can be adjusted to any position from the vertical to 90°. Also available are semi recliner models which recline from vertical to 30°. The detachable 10"/25 cm headrest is standard equipment. Rear wheels are offset on all recliners to provide all the stability required when the back is reclined. Forward Stabilizers (optional) are used in conjunction with elevating legrests where the legrest is fully extended to support a leg in a heavy cast. The stabilizer is adjustable so that it can be set to clear thick carpet or doorway ridges etc. while still performing an anti-tipping function.

E **Model L855A39L-16 Narrow Adult** (shown) or L855A39L-18 Full Adult is a Performance Lightweight with optional Space Saver desk arms to reduce overall chair width without decreasing interior space. Treaded pneumatic rear tires are standard equipment (smooth pneumatic or semi-pneumatic polymer ultralight tires are optional at no charge) to substantially improve the ride over outdoor terrain and reduce weight. To complement the rear pneumatics there are 3 optional front casters available to enhance performance. The 8 x 1¼ Narrow Pneumatic pictured provides an excellent cushioned ride over rough terrain and is also easy to handle over thick carpeting. The 8 x 2 Pneumatic is wider for even better grip and tracking outdoors but requires greater effort over thick carpet surfaces. The 8 x 2 semi-pneumatic has much the same handling characteristics as the 8 x 2 pneumatic (a less cushioned ride but easier to handle on carpet) and while it is heavier it will never puncture or deflate. The standard equipment 8 x 1 Super Tuff solid tire caster is an excellent indoor or outdoor flat surface wheel.

F **The L81039L-18 Full Adult** (shown) or L81039L-16 Narrow Adult is the fixed arm Performance Lightweight. Ideal for those who are concerned about the lifting weight of a wheelchair or who have no need of detachable arm construction to aid in transfer or approaching a desk etc. Laurentian performance Lightweights are also available in Hemi (Low Seat) construction.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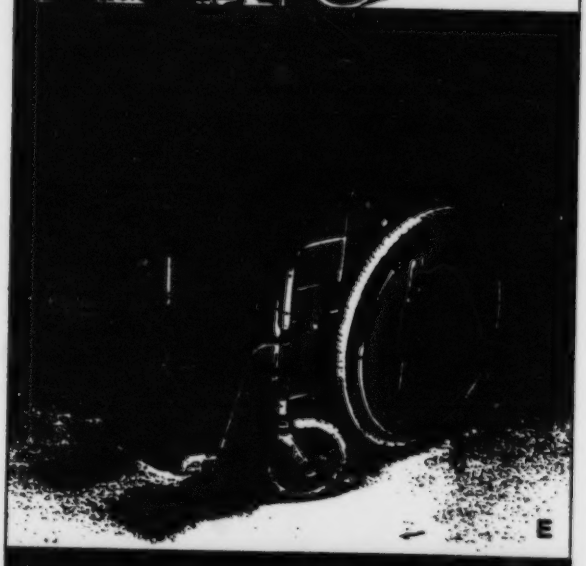
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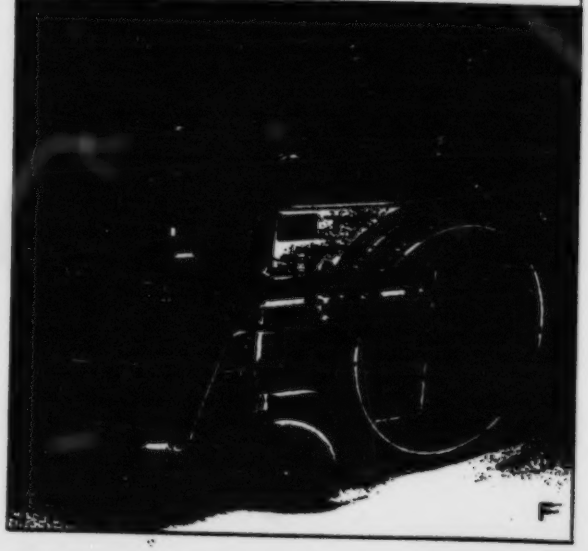
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THE PERFORMANCE LIGHTWEIGHT DIFFERENCE

At Canadian Wheelchair "lighweight" doesn't mean "Fragile, Handle with Care". We take considerable pride in the fact that our lighweight construction wheelchairs will withstand hard and active duty use without "going to pieces". We are continually experimenting with and testing the latest metal alloys in order to reduce weight without sacrificing strength or durability. Frames are hand welded to control the sensitive process of combining metals with differing properties. The result is a product in which you can have confidence.

STANDARD FEATURES: (in addition to standard weight models)

- Selected use of Chrome-moly, and aluminum alloy metals in the frame construction.
- 7/16" rear wheel axle.
- POLYCOMP VR lightweight rear wheels with precision sealed bearing system.
- Treaded pneumatic tires are standard equipment with smooth pneumatic or ultralight semi-pneumatic polymer tires optional at no charge.

POPULAR OPTIONS

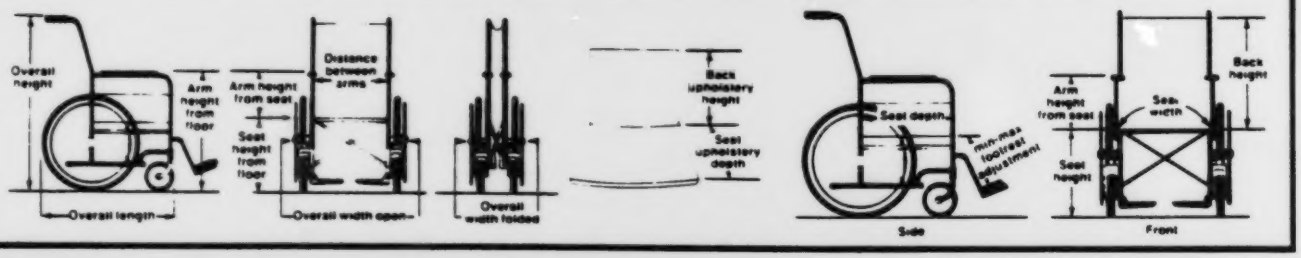
Laurentian wheelchairs offer a number of useful optional accessories. Some are listed below but contact your Canadian Wheelchair dealer or consult our "Popular Options/Accessories" brochures.

■ 1541 WHEELCHAIR TRAY WITH METAL BRACKETS ■ 1541V WHEELCHAIR TRAY WITH VELCRO FASTENER ■ 2117 CRUTCH/CANE HOLDER ■ 2119A SAFETY BELT – AUTO CLOSURE ■ 2119V SAFETY BELT – VELCRO CLOSURE ■ 2121 I.V. POLE – ADJUSTABLE HEIGHT ■ 2127 AMPUTEE ADAPTORS ■ 3111 BRAKE LEVER EXTENSIONS ■ 3116 FORWARD STABILIZERS ■ 4111 LEGSTRAP – VELCRO FASTENING ■ 4112 NYLON HEEL LOOPS ■ 5115 SOLID SEAT INSERT ■ SOLID FOLDING SEAT INSERT ■ 6115T TREADED PNEUMATIC REAR TIRES ■ 6115S SMOOTH PNEUMATIC REAR TIRES ■ 6122 – 24" POLYCOMP VR LIGHTWEIGHT REAR WHEELS WITH THREE TIRE OPTIONS ■ 6116 – 8 X 2 PNEUMATIC CASTERS ■ 6117 – 8 X 1¼ PNEUMATIC CASTERS ■ 6111 PLASTIC COATED HANDRIMS ■ HANDRIMS WITH 8 VERTICAL (6112), HORIZONTAL (6113), OR OBLIQUE (6114) PROJECTIONS ■ 6130 QUICK RELEASE AXLES ■ CLOTH AND VINYL COVERED CUSHIONS – 2", 3", OR 4" THICK.

ORDER CODE KEY

L - Laurentian	8 - 8"	10 - Fixed 15 - Detachable Full Length 15A - Det. Desk Length 15D - Det. Adj. Height Full Length 15AD - Det. Adj. Height Desk Length 55 - Space Saver Full Length 55A - Space Saver Desk Length	Standard (not coded) 21 - Semi-reclining 27 - Full reclining	39 - Swinging Detachable Footrests 40 - Swinging Det. - Elevating Legrests XX - No Footrests	55D - Space Saver Adj. Height Full Length 55AD - Space Saver Adj. Height Desk Length	L - Performance Lightweight HE - Hemi (Low Seat) HEL - Hemi Performance Lightweight	18 - Full Adult 17 - Medium Adult 16 - Narrow Adult

DIMENSIONAL SPECIFICATIONS - Correct at time of publication. Subject to change without notice.



OVERALL	WIDTH OPEN[1]	24½/62	22½/57	24½/62	22½/57	26/66	24/61	26/66		24½/62	22½/57	24	22
	WIDTH FOLDED	9¾/25	•	•	•	11½/29	•	•		9¾/25	•	11¼/29	•
	HEIGHT	36⅞/91	•	34/86	•	36⅞/91	•	34/86		41½/105	•	•	•
	LENGTH[2] (Without Front Rigging)	32/81	•	•	34/	•	•	•		39½/86	38½/98	•	39½/86
SEAT	WIDTH AT SEAT LEVEL	18/46	16/41	18/46	16/41	18/46	16/41	18/46	16/41	18/46	16/41	18/46	16/41
	WIDTH BETWEEN ARMPADS	16/41	14/36	16/41	14/36	18/46	16/41	18/46	16/41	•	14/36	18/46	16/41
	DEPTH	16/41	•	•	•	•	•	•	•	•	•	•	•
	HEIGHT FROM FLOOR	19½/50	•	17⅝/45	•	19½/50	•	17⅝/45	•	19½/50	•	•	•
EXTENSIONS	Footrest MINIMUM	15½/39	•	13/33	•	15½/39	•	13/33	•	15½/39	•	•	•
	Footrest MAXIMUM	21¼/54	•	19/48	•	21¼/54	•	19/48	•	21¼/54	•	•	•
	Legrest MINIMUM	18/46	•	•	•	•	•	•	•	•	•	•	•
	Legrest ELEVATED MAXIMUM	27/69	•	•	•	•	•	•	•	•	•	•	•
WEIGHT	Standard NO FRONT RIGGING	35¾/16.2	35¼/15.9	35¾/16.2	35¼/15.9	39¼/17.8	38¾/17.5	39¼/17.8	38¾/17.5	42¼/19.1	41¾/18.9	47/21.3	46½/21
	Standard NO ARMS OR FRONT RIGGING	N/A	N/A	N/A	N/A	34½/15.6	34/15.4	34½/15.6	34/15.4	N/A	N/A	42¼/19.1	41¾/18.9
	Lightweight NO FRONT RIGGING	32¾/14.8	32¼/14.6	32¾/14.8	32¼/14.6	35½/16.1	35/15.8	35½/16.1	35/15.8	N/A	N/A	N/A	N/A
	Lightweight NO ARMS OR FRONT RIGGING	N/A	N/A	N/A	N/A	30¼/13.7	30¼/13.7	30¼/13.9	30¼/13.7	N/A	N/A	N/A	N/A

[1] Models with Space Saver Arms – reduces width by 1¼"/3 cm [2] L/W Models – reduce length by 1"/2.5 cm
• Same as specification to left N/A Not Applicable

"MOBILITY BY DESIGN"

CANADIAN WHEELCHAIR MFG. LTD.
1360 Blundell Road
Mississauga, Ontario, Canada L4Y 1M5
(416) 275-3960

ULTRALITE PREMIER™ – Children's Models

Ultra Lite
PREMIER

No one is too young to begin enjoying the increased freedom and independence that the Ultralite Premier™ can provide. With its lightweight alloy construction and sturdy strut supported folding mechanism, the Ultralite Premier™ provides unrestricted mobility and responsive performance needed for an active lifestyle.

The Ultralite Premier™ is now available in three children's models: 14" x 14", 12" x 12" and 10" x 10" seat sizes. Unique features designed to meet the special needs of children include vertical drop footplates, high mounted wheel locks and seat depth conversion kits.

Ultralite Premier™ from Everest and Jennings, designed to become an important part of life for all ages.

Everest & Jennings
Special Products For Special Needs | *Produits spéciaux pour besoins Spéciaux*

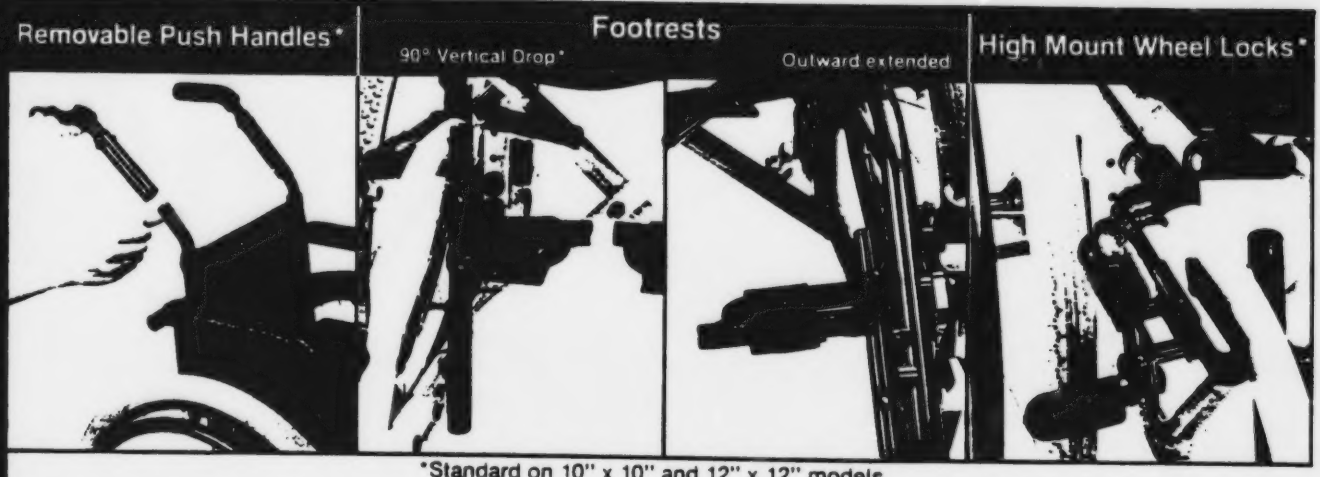
Everest and Jennings Canadian Ltd.
111 Snidercroft Road, Concord, Ontario L4K 2J8
Telephone (416) 669-2381 Telex 06-964539

Everest & Jennings Canada Ltée
2955-2965 Boul. Pitfield, St. Laurent, Québec H4S 1L6
Telephone (514) 337-9423/4

ULTRALITE PREMIER™ – Children's Models

Standard Features:

- 6" ureathane casters
- 22" radial spoked pneumatic wheels
- Adjustable back height
- Sturdy, adjustable height, flip up arms
- Quick release wheels
- 2" seat cushion
- Adjustable caster angle
- Rear anti-tippers (3 horizontal and 3 vertical adjustments)
- Durable epoxy powder coating
- Wheel adjustments for altering center of gravity and seat angles
- Cambre gauge and wrench stored in handy rear pouch
- Lightweight aluminum construction
- Flip up footplates



*Standard on 10" x 10" and 12" x 12" models.

Options:

- 4" ureathane casters
- Growing Kits to increase seat depths: 10" x 10" to 10" x 12"; 12" x 12" to 12" x 14"; 14" x 14" to 14" x 16".
- Safety restraint belts
- Plastic coated handrims
- Caster pin locks
- Two footrest designs

DIMENSIONAL TABLE: Ultralite Premier™ Children's Models

MODELS AVAILABLE			SEAT			ARMS			OVERALL			FOOTREST EXTENSION		
			Width at Seat Level	Depth of Upholstery	Seat Height from Floor (less cushion)	Distance between Arms	Arm Height from Seat Level (Adjustable)	Back Upholstery Height above Seat (Adjustable)	Length without Front Rigging (Variable)	Overall Height (Variable)	Width Open	Minimum	Maximum	Net weight without wheel locks, arms, anti-tippers, cushions, and footrests.
X6M0S26L-H-S	RED YEL	(in)	10	10	18¼	10	7 - 10	10 - 15	30¼ - 33	29½ - 37½	18½	4	9	22.4 lb
	BLU ORN	(cm)	25.4	25.4	46.4	25.4	17.8 - 25.4	25.4 - 38.1	76.8 - 84	75 - 92.3	47	10.2	22.9	10.2 kg
X6T2S26L-H-S	RED YEL		12	12	18¼	12	7 - 10	10 - 15	30¼ - 33	29½ - 37½	20½	4	9	22.9 lb
	BLU ORN		30.5	30.5	46.4	30.5	17.8 - 25.4	25.4 - 38.1	76.8 - 84	75 - 92.3	52	10.2	22.9	10.4 kg
X6C4S26L-H-S	RED YEL		14	14	18¼	14	7 - 10	10 - 15	30¼ - 33	29 - 34	22½	7½	14½	23.4 lb
	BLU ORN		35.6	35.6	46.4	35.6	17.8 - 25.4	25.4 - 38.1	76.8 - 84	73.7 - 86.4	57	19	36.8	10.6 kg

All measurements given are +/- 1 cm (⅜ in) and 0.4 kg (1 lb)

Everest & Jennings

Reorder No. C200-1551

ULTRALITE PREMIER™

The Ultralite Premier™ is now available with swing-away, detachable footrests.

Swingaway, detachable footrests offer greater flexibility to wheelchair users. They allow for closer approaches to beds and bathrooms, easier entrances and exits from the chair and make for easier chair storage. The Ultralite Premier™ blends a proven footrest design with lightweight, durable materials to create an aesthetically pleasing appearance.

Ultralite Premier™ —— the chair designed to be a part of everyday living.

Everest & Jennings

Special Products For Special Needs | Produits spéciaux pour besoins Spéciaux

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Telephone (416) 669-2381 Telex 06-964539

Everest & Jennings Canada Ltee
2955-2965 Boul. Pitfield, St. Laurent, Quebec H4S 1L6
Telephone (514) 337-9423 / 4

ULTRALITE PREMIER™

Ultralite Premier™ Features

- **Lightweight** — Aluminum Alloy frame and lightweight materials provide maximum mobility and freedom.
- **Performance Struts** — Combine the "ride of a rigid frame" with the convenience of a folding chair.
- **Rear Axle Adjustments** — Seat height, center of gravity, seat angle: The Ultralite wrench changes all three with one adjustment, easy and time saving.
- **Adjustable Height / Angle Arms** — Allow arm height adjustment from 9" — 12" above the top of the seat rail and adjustable angle settings to ensure optimal comfort.
- **Quick Release Wheels** — Easy-to-release rear wheels increase portability.
- **Adjustable Anti-Tippers** — Vertical and horizontal adjustments allow for optimal safety and manoeuverability.
- **Warranty** — Sideframes and crossbraces are guaranteed for life of the chair.
- **Folding Feature** — The folding ability allows the Ultralite to be transported easily.
- **Caster Selection** — Choice of 4" or 8" casters mounted on adjustable caster angle plates.
- **Rear Wheel Selection** — 24" spoked wheel or 24" lightweight moulded wheel.
- **Colour Selection** — Red, Blue and Black frames with Black accent trim.
- **Upholstery** — Durable woven Oxford nylon material offers strength and convenience. Standard 2" removable cushion.

The Ultralite Premier™ 770 features easy-to-reach "quad-ease" releases that facilitate disengagement. Dual pin mounts permit the footrests to pivot smoothly out of the way while allowing easy removal by simply lifting off. Also standard are adjustable heel loop straps and strategically placed roller bumpers.

UltraLite Premier™ Series Dimensional Table

Available Models			Width at Seat Level	Depth of Upholstery	Seat Height from Floor (to seat rail)	Distance between Arms	Arm Height from Seat Rail (adjustable)	Arm Height from Floor (adjustable)	Back Upholstery Height above Seat Rail	OVERALL DIMENSIONS			Footrest Extensions		Net Weight less front rigging, wheel locks, arms, anti-tippers, and cushion [1]
										Length without Front Rigging	Overall Height	Overall Width	Minimum	Maximum	
X8E6X-26L-H-S-770-	RED BLU BLK	(in.)	17	16	17 1 2-21 1 2	17	9-12	26 1 2-33 1 2	10-15	31 1 4-34 1 4	29 3 4-38 3 4	26	15	21	26 3 4 lb.
		(cm)	43	40.5	44 5-54 5	43	23-30.5	67-85	25.5-38	79-87	75.5-98.4	66	38	53.5	12.1 Kg.
X8N6X-26L-H-S-770-	RED BLU BLK		16	16	17 1 2-21 1 2	16	9-12	26 1 2-33 1 2	10-15	31 1 4-34 1 4	29 3 4-38 3 4	25	15	21	26 lb.
			40.5	40.5	44 5-54 5	40.5	23-30.5	67-85	25.5-38	79-87	75.5-98.4	63.5	38	53.5	11 8 Kg.
X8P6X-26L-H-S-770-	RED BLU BLK		15	16	17 1 2-21 1 2	15	9-12	26 1 2-33 1 2	10-15	31 1 4-34 1 4	29 3 4-38 3 4	24	15	21	25 1 4 lb.
			38	40.5	44 5-54 5	38	23-30.5	67-85	25.5-38	79-87	75.5-98.4	61	38	53.5	11 5 Kg.
X8E6L-26L-H-S-	RED BLU BLK		17	16	17 1 2-21 1 2	17	9-12	26 1 2-33 1 2	10-15	33 1 2-36 1 2	29 3 4-38 3 4	26	17 1 2	19 1 2	27 1 2 lb.
			43	40.5	44 5-54 5	43	23-30.5	67-85	25.5-38	85-93	75.5-98.4	66	44 5	49.5	12.5 Kg.
X8N6L-26L-H-S-	RED BLU BLK		16	16	17 1 2-21 1 2	16	9-12	26 1 2-33 1 2	10-15	33 1 2-36 1 2	29 3 4-38 3 4	25	17 1 2	19 1 2	26 3 4 lb.
			40.5	40.5	44 5-54 5	40.5	23-30.5	67-85	25.5-38	85-93	75.5-98.4	63.5	44 5	49.5	12.1 Kg.
X8P6L-26L-H-S-	RED BLU BLK		15	16	17 1 2-21 1 2	15	9-12	26 1 2-33 1 2	10-15	33 1 2-36 1 2	29 3 4-38 3 4	24	17 1 2	19 1 2	26 lb.
			38	40.5	44 5-54 5	38	23-30.5	67-85	25.5-38	85-93	75.5-98.4	61	44 5	49.5	11 8 Kg.

1 Four inch casters reduce weights by 1.4 lbs. (0.6 Kg.)

2 Measurements given are ±0.5 cm (1 4 in.) and 0.2 Kg. (1 2 lb.)

Reorder No. C200-1550

Everest & Jennings

Special Products For Special Needs | Produits spéciaux pour besoins spéciaux

APPENDIX F

SCOOTER INFORMATION

If walking is difficult...

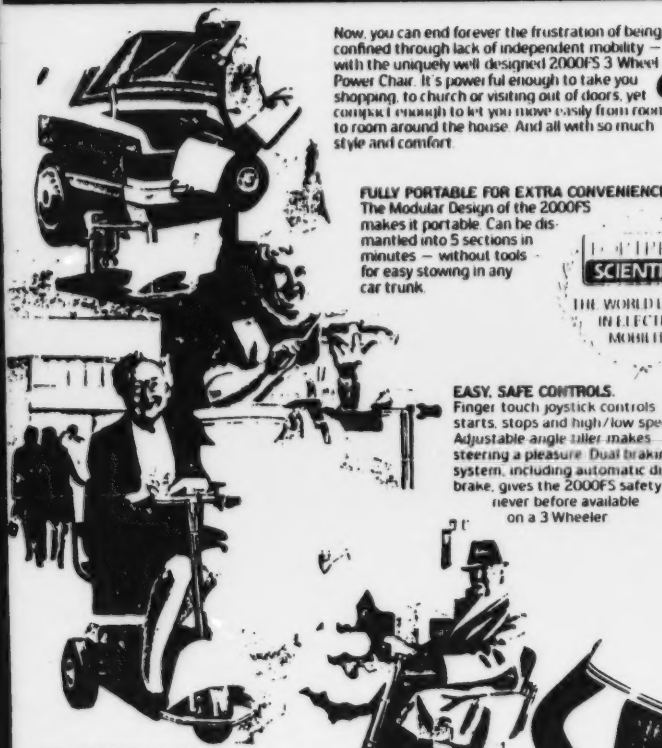
FORTRESS
SCIENTIFIC
A NORTHERN FORTRESS COMPANY

Model 2000FS Electric 3-Wheeler

FORTRESS SCIENTIFIC

A NORTHERN FORTRESS COMPANY

The 2000FS 3-Wheel Power Chair can help make life much easier for you...



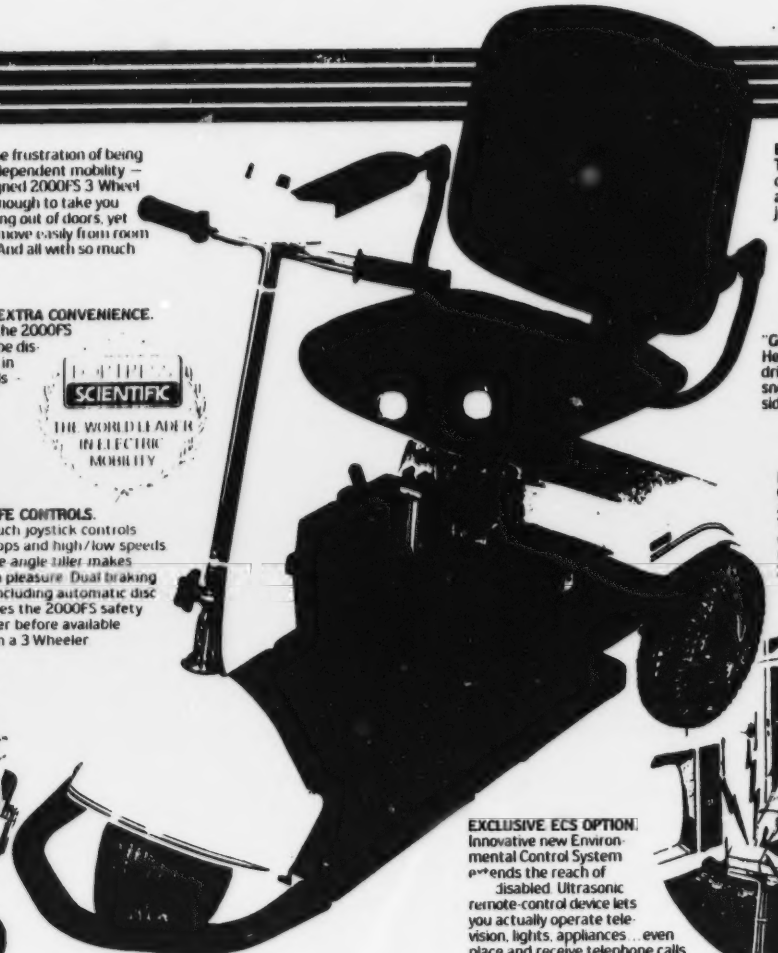
Now, you can end forever the frustration of being confined through lack of independent mobility — with the uniquely well designed 2000FS 3 Wheel Power Chair. It's powerful enough to take you shopping, to church or visiting out of doors, yet compact enough to let you move easily from room to room around the house. And all with so much style and comfort.

FULLY PORTABLE FOR EXTRA CONVENIENCE.
The Modular Design of the 2000FS makes it portable. Can be dismantled into 5 sections in minutes — without tools — for easy stowing in any car trunk.

FORTRESS SCIENTIFIC
THE WORLD LEADER IN ELECTRIC MOBILITY

EASY, SAFE CONTROLS.
Finger touch joystick controls starts, stops and high/low speeds. Adjustable angle tiller makes steering a pleasure. Dual braking system, including automatic disc brake, gives the 2000FS safety never before available on a 3 Wheeler.

NEW FREEDOM TO ROAM.
Go out and about anywhere you choose, self reliant as never before, aboard the 2000FS. Reliable electric motor provides quiet, smooth ride. Stylish modern design, with comfortable seat of your choice from a variety of optional styles.



EXCLUSIVE ECS OPTION.
Innovative new Environmental Control System extends the reach of disabled. Ultrasonic remote-control device lets you actually operate television, lights, appliances ...even place and receive telephone calls, unlock and open doors ...right from the seat of your 2000FS Power Chair!

ECONOMICAL TO OPERATE.
Travel up to 20 miles on a single charge. Re-power overnight from any convenient wall outlet for just pennies of electricity.

"GO-ANYWHERE" POWER.
Heavy-duty electric motor with rear differential drive travels easily over carpeting, grass, gravel, snow; rides you up slopes and inclines and even sidewalk curbs.

MOVE AROUND HOME IN STYLE.
Compact design lets you move around home with complete ease. Tight 40 inch turning radius to weave between furniture, move through rooms or steer the 2000FS outside to enjoy your garden.

WORK IN COMFORT.
Low-profile fully-swivelling seat lets you move right into place anywhere you work. Puts you close to desk, work bench, or kitchen table... comfortable as can be, with ample freedom of movement.

Technical Data on the Quality 2000 FS

General Specifications

DIMENSIONS

Overall Width	24"	61 cm
Overall Length	45" - 49"	114 cm - 124 cm
Standard Tiller Height (from deck)	29"	74 cm
Standard Weight (without batteries)	107 lbs.	49 kg.
Turning Radius	36"	102 cm
Wheel Size (front and rear)	10" x 3"	260 x 85 mm pneumatic

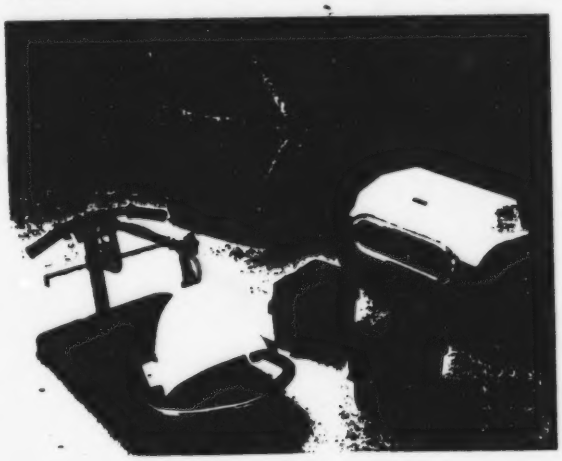
DRIVE SYSTEM
Rear Wheel drive with differential chain and sprocket transmission.

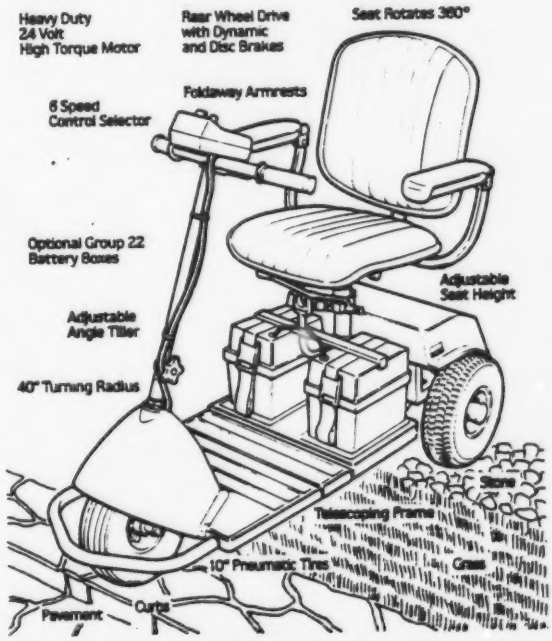
MOTOR
24 V DC permanent magnet high torque gear motor, totally enclosed for indoor and outdoor applications.

BRAKE
Automatic electro-mechanical failsafe brake spring applied and electrically released, manual release of disc brake is provided for free-wheeling. Parking brake is also provided.

MODULAR DESIGN
The 2000FS can be easily dismantled into five modular parts for transporting. Adjustable tiller allows angle of tiller to be changed to suit individual. The unit can also be adjusted in length by 4" to increase legroom if necessary.

SPEED CONTROL
Fully proportional controller with adjustable acceleration, deceleration, braking time, manual adjustable speed knob for maximum speed setting. Finger-touch control lever for forward and reverse operation.





SAFETY FEATURES
Anti-tip device provided for all units. Interlock to prevent the 2000FS from operation when automatic brake has been manually released or when the battery charger is connected to the unit. Thermal cut-out to prevent overloading of controller. Circuit-breaker to protect electrical components under short circuit conditions.

SEATING
Deluxe upholstered seats in 14", 16", and 18" widths. 360-degree swivel and position locking mechanism, tiltable padded arm rests and adjustable back for height and angle of inclination. Seat height can also be adjusted.

PERFORMANCE SPECIFICATIONS
Speed: 0 - 5 mph.
Load Carrying Capacity: 200 lbs.
Range: Up to 20 miles (depending on batteries and load).
Gradability: 9 degrees or 12.5% Max.
Obstacle Clearance Capability: 3".

SERVICE
Parts and service are available from over 500 Fortress Scientific Dealers worldwide, along with strategically located Factory outlets.

FORTRESS SCIENTIFIC
A NORTHERN FORTRESS COMPANY

We invite you to test drive the best...

FORTRESS SCIENTIFIC
61 Miami Street,
Buffalo, New York
U.S.A. 14204

FORTRESS SCIENTIFIC LIMITED
3750 Chesswood Drive
Downsview, Ontario
Canada M3J 2W6

FORTRESS SCIENTIFIC
Hayes Road, Southall,
Middlesex, England UB2 5LZ

AUTHORIZED DEALER

Fortress Scientific reserves the right to alter specifications without notice in the interest of product improvement.

SPECIFICATIONS
(LONG STEEL FRAME MOBIE)

OVERALL DIMENSIONS

- **Length (adjustable):** 44 ' to 45"
- **Width (adjustable):** 22" to 26"
- **Overall Height:** 37½"
- **Tiller Height:**31½" from platform
- **Seat Height (adjustable):** 15" to 18" from platform
- **Width between armrests:** 18"
- **Height of armrests:** 8½" from seat

Turning Radius: 32"
Total Weight: 72 lbs (without batteries)

- **Weight of Base:** 28 lbs
- **Weight of Power Head:** 25 lbs
- **Weight of Seat:** 16 lbs
- **Weight of Tiller:** 3 lbs
- **Weight of Batteries:** 22 lbs each x 2

Maximum Forward Speed: 4.2 mph
Maximum Reverse Speed: 3.9 mph
Speed Control: Pulse width modulated proportional
Batteries: 2 - 12-volt Gel-cell
Range: over 20 miles per charge*

* Actual range may vary depending on conditions.

AUTHORIZED DEALER

Everest & Jennings

Special Products For Special Needs | *Produits spéciaux pour besoins spéciaux*

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Personal.
Portable.
Powerful.

mobie™

From
Everest & Jennings

made in CANADA

mobie is mobility.

Now there is a convenient, portable way to get around physical limitations, and just to get around.

It's called Mobie. And it's made in Canada by the world leader in the field of mobility, Everest & Jennings.

Mobie is a three-wheeled, electric-powered scooter that provides safe, dependable mobility and support.

LONG FIBREGLASS BASE

mobie is independence.

Mobie is simple to operate. Large switches provide smooth variable speed control for both forward and reverse with just light thumb pressure. Braking is smooth and automatic – just release the thumb switch.

When the power is off, Mobie freewheels for easy pushing.

Mobie is quickly and easily dismantled into five compact parts for simple transport in the trunk of any car. The heaviest piece weighs just 28 pounds. Reassembly is also fast, and requires no tools.

mobie is security.

Mobie is designed for stable, trouble-free operation. The rear axles telescope to provide a wide wheelbase, and front wheel drive provides smooth, dependable power.

The smooth, quiet propulsion system can climb a 7° grade, and it can go 20 miles between charges.* Sealed gel cell batteries, provided with each Mobie, are IATA approved for air travel and will give you reliable and maintenance free service.

mobie is for you.

Mobie is available in several sizes. Choose from the long fibreglass base or the short, medium and long steel base models. Ask your dealer about available options. Once you've given a Mobie a test ride, you'll want to take it home.

***Actual range may vary depending on conditions.**

APPENDIX G

AIR CANADA SEATING LAYOUTS
B-727, B-767, B-747, L1011, DC-9

SUMMARY TABLE

WHEELCHAIR PASSENGER SEATING ACCESS
AIR CANADA SEATING LAYOUTS

AIRCRAFT TYPE: BOEING 727

SEATING LAYOUT: 34 Business, 102 Economy

SEAT NUMBERS	ACCESS ROUTE
26C, 26D	-Wheelchair Passenger can get just behind these seats, adjacent to AFT coat room and stowage cabinets, via entry from Doors #7 or #8, similar access for scooters -There is no access to the business section from the front due to the divider between the forward galley and business section.
TOTAL: 2 Seats	

AIRCRAFT TYPE: BOEING 747-233

SEATING LAYOUT: 26 First Class, 270 Economy, 6 Pallets

SEAT NUMBERS	ACCESS ROUTE
10A, 10B, 7C 7D, 11B, 12C	-Wheelchair or Scooter access to these seats from either Door #1 or #2, no obstructions shown.
19A, 19B, 19C 19D, 19E	-Wheelchair or Scooter access to these seats from either Door #3 or #4, no obstructions shown
31A, 31B, 31C	-Wheelchair or Scooter access to these seats from Door #5 only
31D, 31E, 31F	-Wheelchair or Scooter access to these seats from Door #6 only.
TOTAL 17 SEATS	

AIRCRAFT TYPE: L1101-500

SEATING LAYOUT: 12 Sleeperettes, 24 First Class, 178 Economy

SEAT NUMBERS	ACCESS ROUTE
1A, 1B, 1D, 1E, 1H, 1J	Wheelchair or Scooter access to these seats from either Door #1 or #2, however Door #2 is more desirable. Aisle width appears to be approximately 25" between seats, therefore it may be possible for a Scooter to have access to all the aisle seats in the Sleeperette and First Class Sections.
18A, 18B, 19C	Wheelchair or Scooter access to these seats from Door #3, no obstructions shown
18H, 18J, 19G	Wheelchair or Scooter access to these seats from Door #4, no obstructions shown

TOTAL 12 SEATS

AIRCRAFT TYPE: BOEING 727

SEATING LAYOUT: 144 Economy

SEAT NUMBERS	ACCESS ROUTE
1C, 1D	Wheelchair access to front row aisle seats. However, as turning radius near Door #1 is approximately 28" it is unlikely a Scooter could negotiate it.
24C, 24D	Wheelchair access and possibly Scooter to these aisle seats from Door #8. Final position is adjacent and to the rear of the seats along side AFT coat room and storage areas.

TOTAL 4 SEATS

AIRCRAFT TYPE: BOEING 747

SEATING LAYOUT: Total 496 Economy or 18 Business Upper Deck and 466 Economy

SEAT NUMBERS	ACCESS ROUTE
10A, 10B, 10C 10H, 10J, 10K	Wheelchair or Scooter access to these seats from Doors #1 or #2, no obstructions shown.
19A, 19B, 19C 19H, 19J, 19K	Wheelchair or Scooter access to these seats from Doors #3 or #4
32A, 32B, 32C	Wheelchair or Scooter access to these seats from Door #5
32H, 32J, 32K	Wheelchair or Scooter access to these seats from Door #6
43A, 43B, 43C 43J, 43K	Wheelchair or Scooter access to these seats from Doors #7 or #8

TOTAL 23 SEATS

AIRCRAFT TYPE: BOEING 767

SEATING LAYOUT: 10 First Class, 177 Economy

SEAT NUMBERS	ACCESS ROUTE
1A, 1B, 1D 1E, 1G	Wheelchair access to these seats, Scooter access to only 1B and 1D via Door #1. Tight turning radius restricts Scooter.

TOTAL 5 SEATS

AIRCRAFT TYPE: DC-9/32

SEATING LAYOUT: 100 Economy

SEAT NUMBERS	ACCESS ROUTE
2B, 2C	Wheelchair access only to these aisle seats via Door #1. Tight turning radius not suitable for Scooters.
21B, 21C	Wheelchair and Scooter access to these seats from rear emergency Door #7, closest approach is behind the seats and adjacent to the rear service cart stowage area.

TOTAL 4 SEATS

AIRCRAFT TYPE: L1011

SEATING LAYOUT: 14 First Class, 292 Economy

SEAT NUMBERS	ACCESS ROUTE
1A, 1B, 1D	Wheelchair or Scooter access to these seats via Door #1, no obstructions shown
1E	Wheelchair or Scooter access to this seat via Door #2
21B, 21C	Wheelchair access to the rear of these aisle seats via Door #3, Scooter access is tight, due to turning radius, but possible.
21G, 21H	Wheelchair access to the rear of these aisle seats via Door #4, Scooter access is tight due to turning radius, but possible.
39C, 39D, 39E 39F	Wheelchair or Scooter access to these seats via Doors #5 or #6, no obstructions shown

TOTAL 12 SEATS

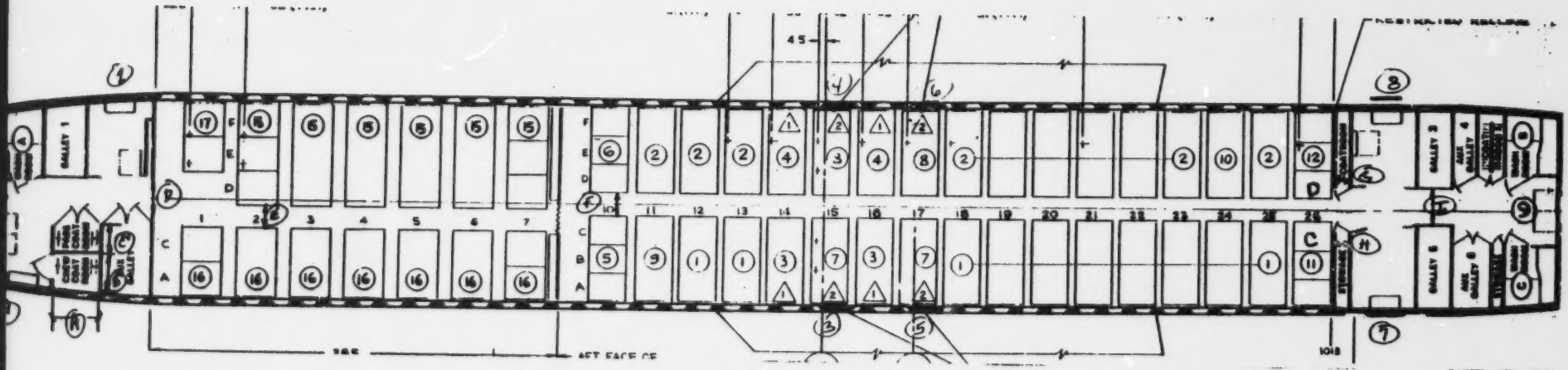
BOEING 727

AIR CANADA SEATING LAYOUT (34 Business, 102 Economy)

DRAWING # 05-40128 (sheet 1 of 1) 2 pieces

EXITS: TOTAL OF 9 (5 and 4 emergency)

REFERENCE	DESCRIPTION	DIMENSION *SCALED inches
1	Door Cockpit, Port Side	36
2	Door Cockpit, STBD Side	32
3	Door Emergency, Port Side	20
4	Door Emergency, STBD Side	20
5	Door Emergency, Port Side	20
6	Door Emergency, STBD Side	20
7	Door AFT Galley Area, Port Side	32
8	Door AFT Galley Area, STBD Side	32
9	Door AFT Section	35
A	Coat Room Width, Forward, Port Side	33
B	Coat Room Depth, Forward, Port Side	27
C	Pass Coat Room Depth, Forward Port	21
D	Aisle Width Forward Galley	21
E	Aisle Width Between Seats Bus. Class	17
F	Aisle Width Between Seats Economy Class	17
G	Rear Coat Room Width	11
H	Rear Storage Room Width	11
I	Aisle Width, Rear Galley	25



						727
		PART NUMBER	DESCRIPTION	SIZE	MATERIAL OR VENDOR	
		ODD DASH NUMBER SHOWN - NEXT EVEN DASH NUMBER OPPOSITE				
			DRAWN	P. G. D.	SEATING LAYOUT-	
			CHECKED		34 BUSINESS CLASS	
			DESIGNED	P. G. DRIDGE	102 ECONOMY	
			STRESSED		(TOTAL 136)	
			APPROVED			
			APPR DATE	81-9-14	AIR CANADA	05-40128
			SCALE	1/40		

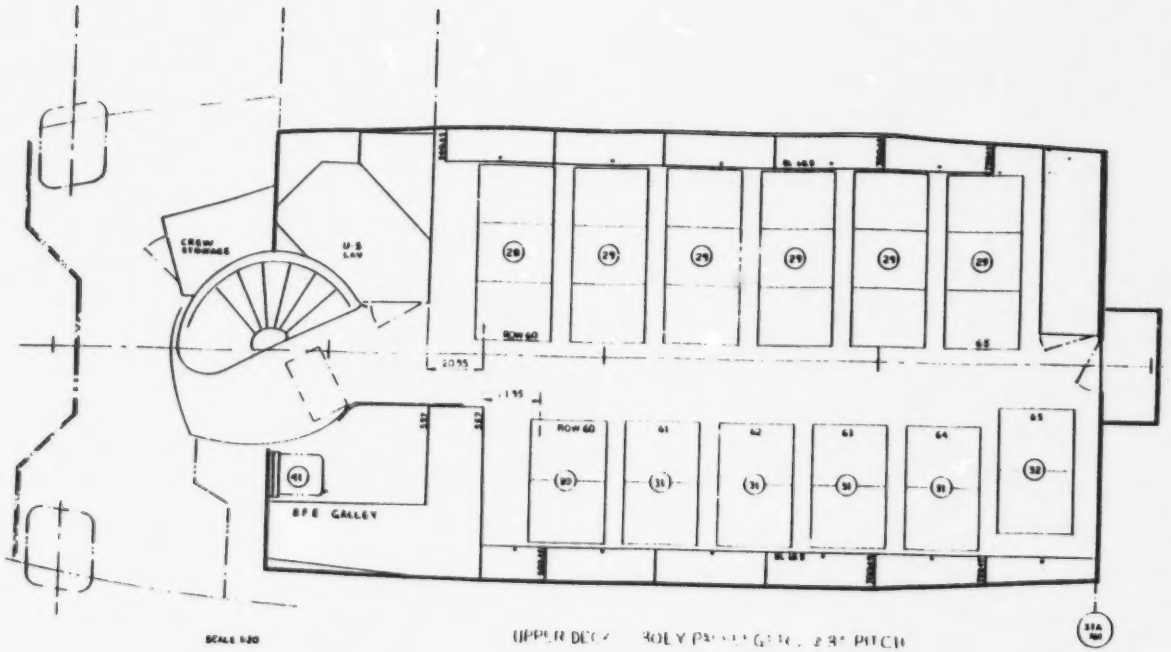
BOEING 747-233

AIR CANADA SEATING LAYOUT (26 First Class, 270 Economy, 6 Pallets)

DRAWING # 05-30161 (sheet 1 of 1) 2 pieces

EXITS: TOTAL OF 8

REFERENCE	DESCRIPTION	DIMENSION *Scaled inches
1	Door Cockpit, Port Side	45
2	Door Cockpit, STBD Side	45
3	Door (Fwd) Galley STBD Side	45
4	Door (Fwd) Galley Port Side	45
5	Door Rear Lavatory Port Side	45
6	Door Rear Lavatory STBD Side	45
7	Door Rear Galley Complex STBD Side	45
8	Door Rear Galley Complex Port Side	45
A	Aisle Width Around Stairwell, Port Side	25
B	Aisle Width Around Stairwell, STBD Side	23
C	Aisle Width Between Seats and Galley #1, Port	35
D	Aisle Width Between Seats and Galley #1, STBD	25
E	Aisle Width Between Seats and (Fwd) Lavatory Port Side	20
F	Aisle Width Between Seats and (Fwd) Lavatory STBD Side	33
G	Aisle Width Between Seats Zone "B", Port	20
H	Aisle Width Between Seats Zone "B", STBD	20
I	Aisle Width Between Seats and Storage Unit, Port	20
J	Aisle Width Between Seats and Storage Unit, STBD	20
K	Aisle Width Between Seats and Galley Complex, Port Side	25
L	Aisle Width Between Seats and Galley Complex, STBD Side	20
M	Aisle Width Between Seats Zone "C", Port	20
N	Aisle Width Between Seats Zone "C", STBD	20
O	Aisle Width Between Seats and Storage Unit, Port	20
P	Aisle Width Between Seats and Storage Unit, STBD	23
Q	Aisle Width Between Seats and Rear Lavatories, Port Side	25
R	Aisle Width Between Seats and Rear Lavatories, STBD Side	23
S	Aisle Width Between Seats, Zone "D", Port	20
T	Aisle Width Between Seats, Zone "D", STBD	20
U	Aisle Width Between Seats and Rear Galley, Port	23
V	Aisle Width Between Seats and Rear Galley, STBD	18



			-1	LAYOUT					306
NO WERE	NO NEED	ITEM NO	PART NUMBER	DESCRIPTION	SIZE	MATERIAL OR VENDOR	NO USED PER AIRCRAFT	NEXT HIGHER ASSY DRAWING NUMBER OR 10/0 REFERENCE	ASSIGN NO TYP NO USED
			000 DASH NUMBER SHOWN	NEXT EVER DASH NUMBER OPPOSITE					

ALL DRAWING AND DRAFTSMANSHIP PRACTICES ARE BASED ON THE SAE DRAWING STANDARDS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
UNSPECIFIED TOLERANCES
FRACTIONAL ± | DECIMAL .X ± | .XX ± | .XXX ± | ANGLE ±

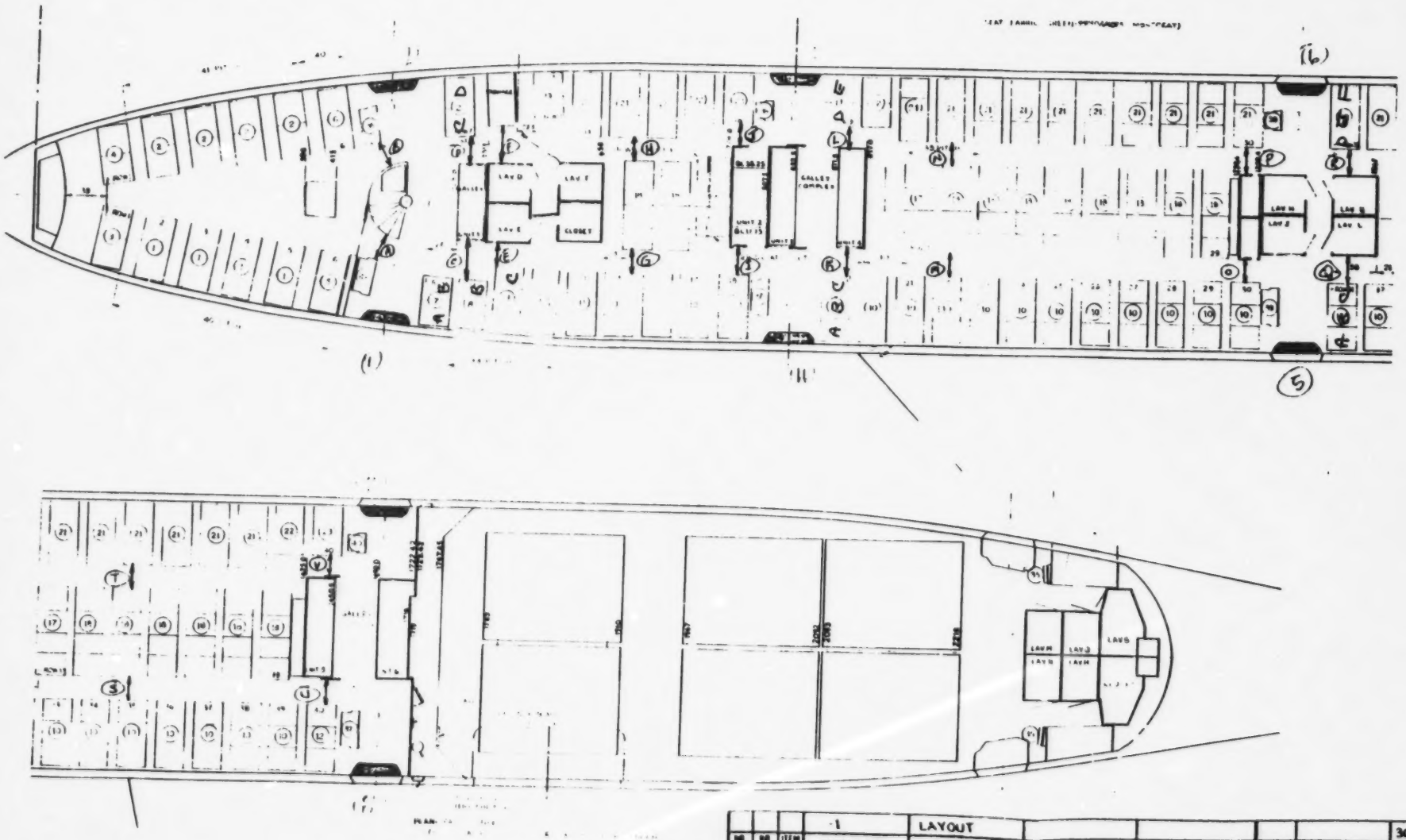
DRAWN	DNC 9-11-79	SEATING LAYOUT
CHECKED	F G S	747-233
DESIGNED		26 F/C · 270 FY · 296 TOT
STRESSED		

MODIFICATION OR REPAIR TO

SUPERSEDES

REFERENCE

Boeing 747 - Upper Deck



			-1	LAYOUT					306
NO. REQD	NO. REQD	ITEM NO.	PART NUMBER	DESCRIPTION	SIZE	MATERIAL OR VENDOR	NO. REQD PER AIRCRAFT	NEXT HIGHER ASSY DRAWING NUMBER OR 10-D REFERENCE	ASSIGN NO. TYP NO. REQD
			000 DASH NUMBER SHOWN	NEXT EVER DASH NUMBER OPPOSITE					MODIFICATION OR REPAIR TO
ALL DRAWING AND DESIGNING PRACTICES ARE BASED ON THE SAE DRAWING STANDARDS UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES UNSPECIFIED TOLERANCES				DRAWN	DWG 9-11-79	SEATING LAYOUT			SUPERSEDES
				CHECKED	F.G.	747-233 -10ABREAST			
				DESIGNED		36 F/C -270 FY - 296 TOT			REFERENCE
				APPROVED					

Boeing 747

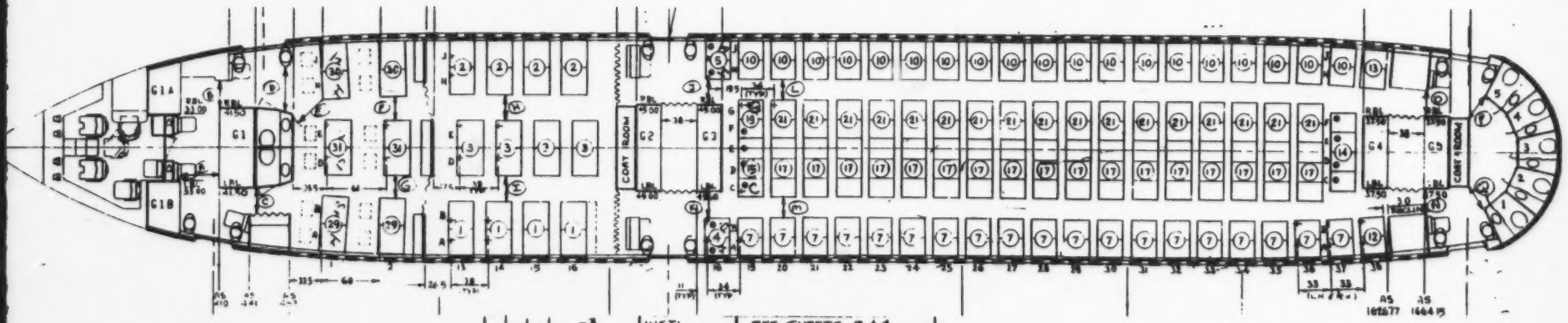
L1101-500

AIR CANADA SEATING LAYOUT (12 Sleeperettes, 24 First Class, 178 Economy)

DRAWING # 05-50174

EXITS: TOTAL OF 6

REFERENCE	DESCRIPTION	DIMENSION *SCALED inches
1	Door, Cockpit Port Side	37½
2	Door, Forward STBD. Side	42½
3	Door, Coat Room Area Port Side	40
4	Door, Coat Room Area STBD Side	40
5	Door, AFT Section Port Side	40
6	Door, Aft Section STBD Side	40
A	Aisle Width Forward Galley	40
B	Aisle Width Forward Galley, STBD Side	27½
C	Aisle Width Forward Galley, Port Side	25
D	Aisle Width Washroom To Wall STBD Side	45
E	Turning Radius Sleeperette to Washroom	35
F	Aisle Width Sleeperettes STBD Side	25
G	Aisle Width Sleeperettes Port Side	25
H	Aisle Width First Class STBD Side	25
I	Aisle Width First Class Port Side	25
J	Aisle Width Economy to Mid Galley STBD Side	27½
K	Aisle Width Economy to Mid Galley Port Side	27½
L	Aisle Width Between Seats STBD Side	20
M	Aisle Width Between Seats Port Side	20
N	Aisle Width Rear Galley Port Side	25
O	Aisle Width Rear Galley STBD Side	25
P	Aisle Width Coat Room to AFT Lavatory STBD Side	27½
Q	Aisle Width Coat Room to AFT Lavatory Port Side	27½



	-3	INSTL	SEE SHEETS 3 & 4		
	-1	INSTL	SEE SHEETS 1 & 2		
QC HOLD	QC HOLD	ITEM NO	PART NUMBER	DESCRIPTION	SIZE / MATERIAL OR VENDOR
ODD DASH NUMBER SHOWN			NEXT EVEN DASH NUMBER OPPOSITE		

DRAWN	KARL SHAW	SEATING LAYOUT- 12 SLEEPERETTES 24 FIRST CLASS 178 ECONOMY (9 ABREST)
CHECKED	VM 10/22	
DESIGNED	TO WOOD	
STRESSED		
APPROVED		
APPR DATE	11/9/22	AIR CANADA ENGINEERING
SCALE 1/50		05-50174

Lockheed L1011-500

BOEING 727

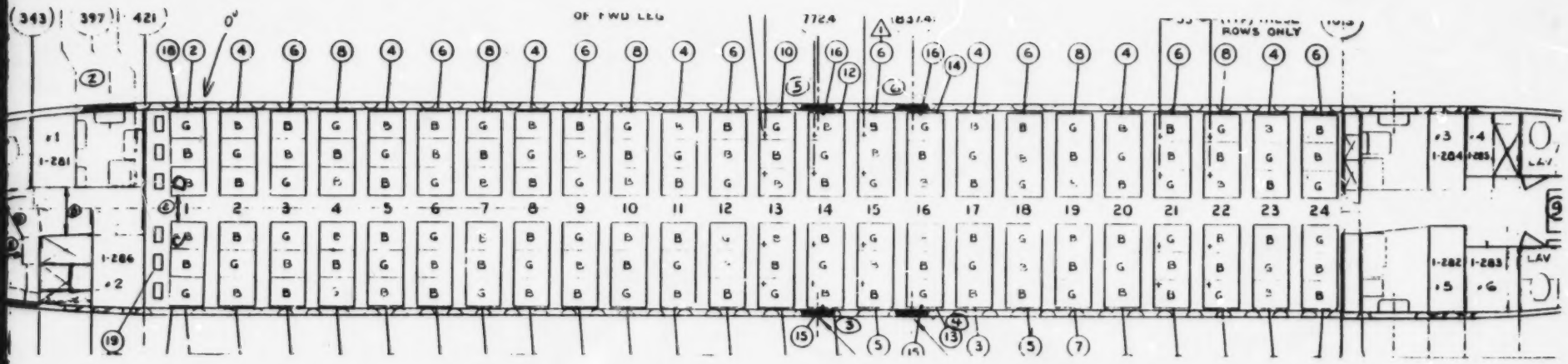
AIR CANADA SEATING LAYOUT (144 Seats Economy)

DRAWING # 05-40025 (Sheet 1 of 1) 2 pieces

EXITS: TOTAL OF 9 (5 + 4 emergency only) ON WINGS

REFERENCE	DESCRIPTION	*DIMENSION SCALED inches
1	Door, Cockpit, Port Side	36
2	Door, Forward Galley STBD Side	32
3	Door, Emergency Port wing	20
4	Door, Emergency Port Wing	20
5	Door, Emergency STBD Wing	20
6	Door, Emergency STBD Wing	20
7	Door, Rear Galley STBD Side	32
8	Door, Rear Galley Port Side	32
9	Door, Rear Lavatory, AFT Section	28
A	Aisle Width, Port Side	30
B	Aisle Width, Forward	32
C	Aisle Width, Between Seats	18
D	Turning Radius, Forward Aisle 90°	28
E	Rear Aisle, Between Stowage Lockers	30
F	Aisle Width, Rear STBD Side	40
G	Aisle Width, Aft Section	24
H	Turning Radius, Rear Aisle	30

* Dimensions are the smallest shown in area considered.



											727
NO REQD	NO PER	ITEM NO	PART NUMBER	DESCRIPTION	SIZE	MATERIAL OR VENDOR	NO REQD PER AIRCRAFT	NEXT HIGHER ASSY DRAWING NUMBER OR W D REFERENCE	AIRCRAFT NO TYPE
			000 DASH NUMBER SHOWN	NEXT EVEN DASH NUMBER OPPOSITE					DO NUMBER

ALL DIMENSIONS AND DIMENSIONING PRACTICES ARE BASED ON THE SAE DRAWING STANDARDS	DRAWN	JVP 210CT74	SEATING LAYOUT- 144 ECONOMY
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES UNSPECIFIED TOLERANCES FRACTIONS X DECIMAL XX .03 XXX .010 ANGLE	CHECKED	FGS	MODIFICATION OR REPAIR TO
	DESIGNED	[illegible]	SUPERSEDES
	STRESSED		MANUAL REFERENCE
✓ SURFACE FINISH PER ABA001 EXCEPT AS NOTED	APPROVED		AIR CANADA MAINTENANCE ENGINEERING
FINISH	APPR DATE	29 11 74	05-40025
HEAT TREAT	SCALE	1/40	SIZE R SHEET NO OF

Boeing 727

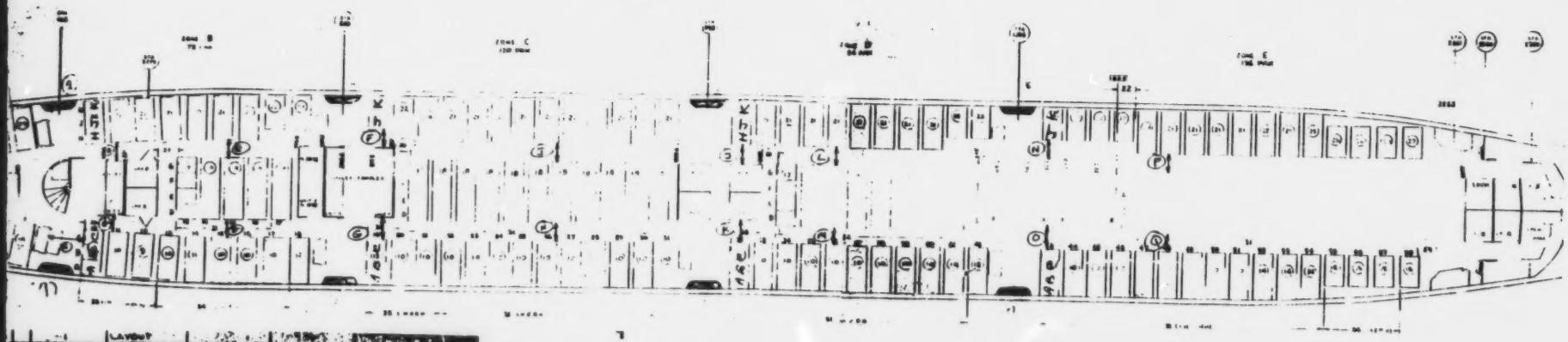
BOEING 747

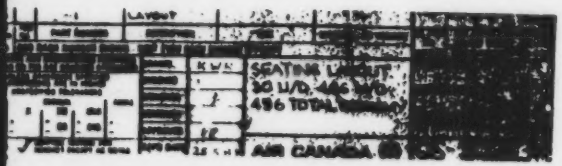
AIR CANADA SEATING LAYOUT (30 Upper Deck, TOTAL 496 Economy (OR)
18 Business Class Upper Deck & 466 Economy)

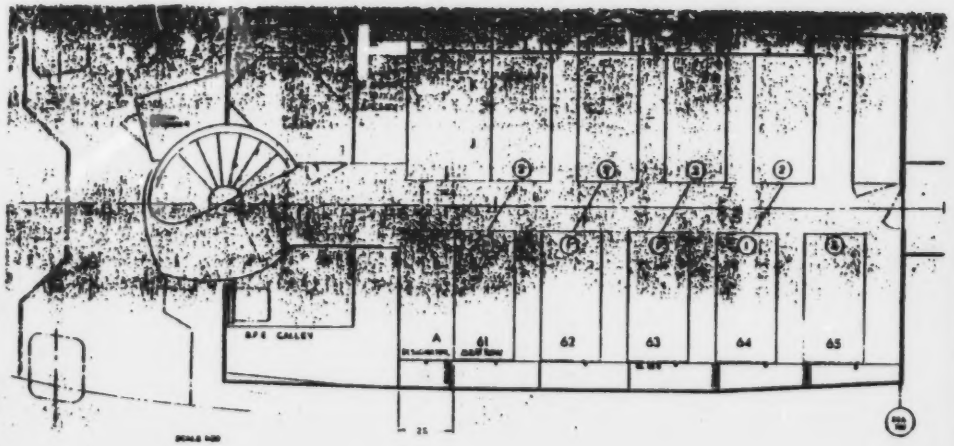
DRAWING # 05-30223 (3 pieces)

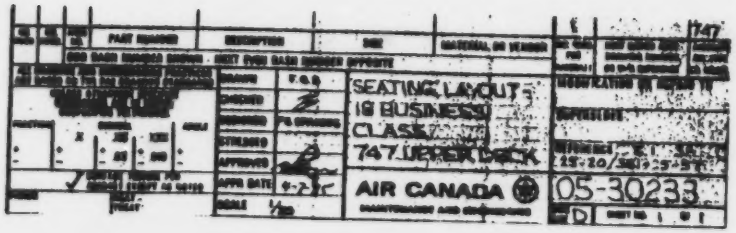
EXITS: TOTAL OF 8

REFERENCE	DESCRIPTION	DIMENSION *SCALED inches
1	Door, Cockpit Port Side	45
2	Door, Cockpit STBD Side	45
3	Door, Galley Complex Port Side	45
4	Door, Galley Complex STBD Side	45
5	Door, Mid Cabin Port Side	45
6	Door, Mid Cabin STBD Side	45
7	Door, Rear Service Center Port Side	45
8	Door, Rear Service Center STBD Side	45
A	Aisle Width, Doorway Port Side Forward	45
B	Aisle Width Between Seats and Galley #1 STBD	22½
C	Aisle Width Between Seats and Galley #1 Port	22½
D	Aisle Width Between Seats Zone "B" Port	22½
E	Aisle Width Between Seats Zone "B" STBD	22½
F	Aisle Width Between Seats & Galley Complex STBD	22½
G	Aisle Width Between Seats & Galley Complex Port	27½
H	Aisle Width Between Seats Zone "C" Port	22½
I	Aisle Width Between Seats Zone "C" STBD	22½
J	Aisle Width Between Seats & Lavatories Zone "D" STBD	25
K	Aisle Width Between Seats & Lavatories Zone "D" Port	27½
L	Aisle Width Between Seats Zone "D" STBD	22½
M	Aisle Width Between Seats Zone "D" Port	22½
N	Aisle Width Between Seats and AFT Service Units, STBD	22½
O	Aisle Width Between Seats and AFT Service Units, Port	30
P	Aisle Width Between Seats Zone "E" STBD	22½
Q	Aisle Width Between Seats Zone "E" Port	22½









Boeing 747 - Best Copy Available

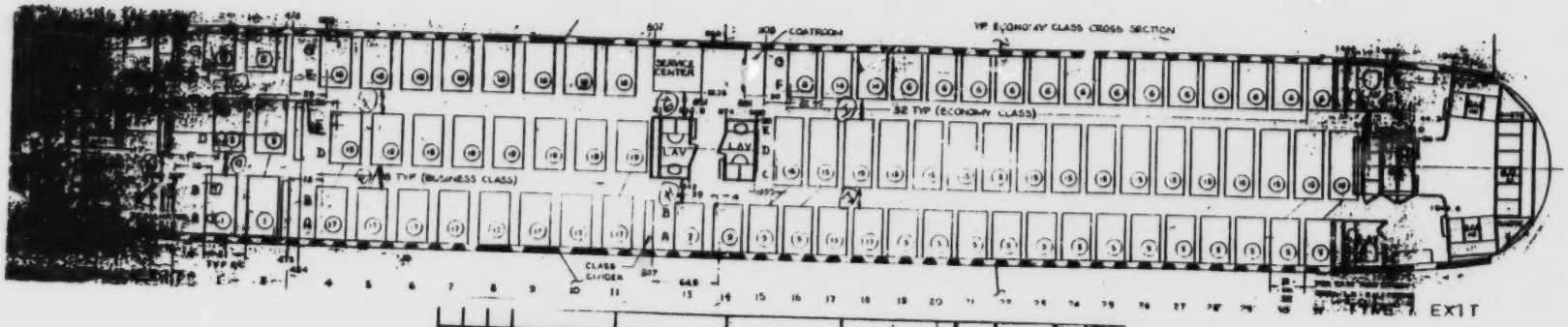
BOEING 767

AIR CANADA SEATING LAYOUT (10 First Class, 177 Economy)

DRAWING # 05-60038 (Sheet 3 of 3) 4 pieces

EXITS: TOTAL OF 6 (4 + 2 emergency only)

REFERENCE	DESCRIPTION	DIMENSION *SCALED inches
1	Door, Cockpit Port Side	42
2	Door, Forward STBD Side	42
3	Door, Emergency STBD Side	20
4	Door, Emergency Port Side	20
5	Door, AFT STBD Side	42
6	Door, AFT Port Side	42
A	Aisle Width Forward Galley Port	25½
B	Aisle Width Forward Galley STBD	25½
C	Aisle Width Between Seats, 1st Class STBD	21
D	Aisle Width Between Seats, 1st Class Port	21
E	Aisle Width Between Seats Business Class Port	21
F	Aisle Width Between Seats Business Class STBD	21
G	Aisle Width Mid Cabin Service Center STBD	25½
H	Aisle Width Mid Cabin Service Centre Port	21
I	Aisle Width Between Seats Economy STBD	19
J	Aisle Width Between Seats Economy Port	19



SEATING LAYOUT -
10 FIRST CLASS
48 BUSINESS
121 ECONOMY

AIR CANADA

05-60038

Boeing 767

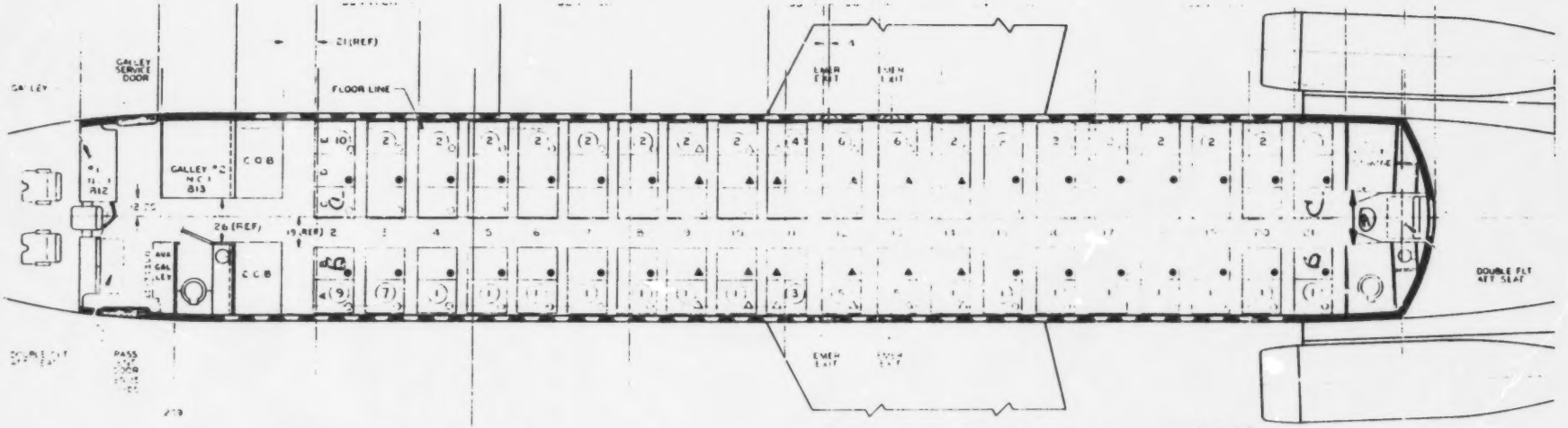
DC-9/32

AIR CANADA SEATING LAYOUT (100 All Economy)

DRAWING # 05-70310 (Sheet 2 of 2) 3 pieces

EXITS: TOTAL OF 7 (3 + 4 Emergency Only)

REFERENCE	DESCRIPTION	DIMENSION *SCALED inches
1	Door Cockpit Port Side	31½
2	Door Forward STBD Side	27
3	Door Emergency Port Side	20
4	Door Emergency STBD Side	20
5	Door Emergency Port Side	20
6	Door Emergency STBD Side	20
7	Door AFT Tail Section Side	25
A	Aisle Width AFT, Service Stowage to Lavatory	36



NO. REQD	NO. REQD	ITEM NO.	PART NUMBER	DESCRIPTION	SIZE	MATERIAL OR VENDOR	NO. REQD. PER AIRCRAFT	NEXT HIGHER ASSY. DRAWING NUMBER OR W/D REFERENCE	DC-9/32 AIRCRAFT NO. TYPE OR MODEL
			000 DASH NUMBER SHOWN - NEXT EVEN DASH NUMBER OPPOSITE						

ALL DRAWING AND DIMENSIONING PRACTICES ARE BASED ON THE SAE DRAWING STANDARDS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
UNSPECIFIED TOLERANCES

FRACTION	DECIMAL X	DECIMAL XX	DECIMAL XXX	ANGLE
±	±	± .03	± .010	±

✓ SURFACE TEXTURE PER ASA B46.1 EXCEPT AS NOTED

FINISH | HEAT TREAT

DRAWN	JVP 16APR81
CHECKED	VM 6-5-81
DESIGNED	F.G.S.
STRESSED	
APPROVED	
APPR DATE	7-5-81
SCALE	—

SEATING LAYOUT-100 ALL ECONOMY WIDE BODY CONFIGURATION

AIR CANADA
MAINTENANCE ENGINEERING

MODIFICATION OR REPAIR TO

SUPERSEDES:

REFERENCE:

05-70310

DWG SIZE B | SHEET NO. 2 OF 2

L1011

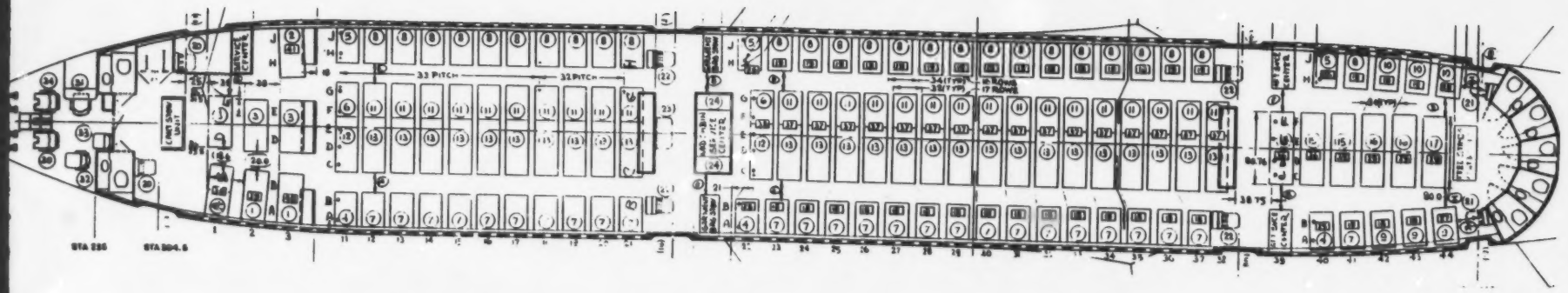
AIR CANADA SEATING LAYOUT (14 First Class, 292 Economy)

DRAWING # 05-50205 (Sheet 1 of 1) 3 pieces

EXITS: TOTAL OF 8

REFERENCE	DESCRIPTION	DIMENSION *SCALED inches
1	Door Cockpit Port Side	44½
2	Door Forward STBD Side	44½
3	Door Mid Cabin Port Side	44½
4	Door Mid Cabin STBD Side	44½
5	Door AFT Service Center Port Side	44½
6	Door AFT Service Center STBD Side	44½
7	Door AFT Section Port Side	24
8	Door AFT Section STBD Side	24
A	Turning Radius Forward Service Centre	24
B	Aisle Width Mid Cabin Service Centre STBD	24
C	Aisle Width Mid Cabin Service Centre Port	24
D	Aisle Width Between Seats Mid Section STBD	22
E	Aisle Width Between Seats Mid Section Port	22
F	Aisle Width AFT Section Service Centre STBD	27½
G	Aisle Width AFT Section Service Centre Port	29½
H	Aisle Width AFT Section Between Seats STBD	22
I	Aisle Width AFT Section Between Seats Port	22
J	Aisle Width Door AFT Section STBD	24
K	Aisle Width Door AFT Section Port	24
L	Aisle Width Forward Section Between Seats STBD	22
M	Aisle Width Forward Section Between Seats Port	22

* NOTE: Drawing is badly done; scale not consistent.



NO REQD	NO REQD	ITEM NO	PART NUMBER	DESCRIPTION	SIZE	MATERIAL OR VENDOR	NO REQD PER AIRCRAFT	NEXT HIGHER ASSY DRAWING NUMBER OR W/D REFERENCE	AIRCRAFT NO TYPE OR MODEL
			ODD DASH NUMBER SHOWN NEXT EVEN DASH NUMBER OPPOSITE						L-1011

ALL DRAWING AND DIMENSIONING PRACTICES ARE BASED ON THE SAE DRAWING STANDARDS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
UNSPECIFIED TOLERANCES

FRACTION	DECIMAL X	DECIMAL XX	DECIMAL XXX	ANGLE
±	±	± 03	± 010	±

✓ SURFACE TEXTURE PER ASA B46.1 EXCEPT AS NOTED

FINISH | HEAT TREAT

DRAWN	KB JUL 85
CHECKED	
DESIGNED	
STRESSED	
APPROVED	
APPR DATE	
SCALE	1/50

SEATING LAYOUT-
14 F/C, 292Y

AIR CANADA
MAINTENANCE AND ENGINEERING

MODIFICATION OR REPAIR TO

SUPERSEDES

REFERENCE
E.I. 5-25-20/351-25-125

05-50205

DWG SIZE R | SHEET NO 1 OF 1

Lockheed L-1011

APPENDIX H

TRANSPORT CANADA
CANADIAN AIR TRANSPORTATION ADMINISTRATION
ENGINEERING AND INSPECTION MANUAL
PARTS I AND II

CANADIAN AIR TRANSPORTATION ADMINISTRATION

ENGINEERING AND INSPECTION MANUAL

PARTS I AND II

TECHNICAL INSTRUCTIONS
AND PROCEDURES
REGARDING CIVIL AIRCRAFT

REVISED (1971) EDITION INCLUDING AMENDMENTS NUMBERS 1 TO 12

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PART I - PROCEDURE

CHAPTER I - DEFINITIONS

1.1 DESIGN APPROVAL REPRESENTATIVE

1.1.1 A Design Approval Representative is one who, by reason of his training and experience in aeronautics, is capable of professional responsibility for the drawings, calculations, test and engineering reports necessary to substantiate the airworthiness of a design, a repair or modification and who has been approved by the Department. Normally such approval will only be recognized during the period of the D.A.R.'s employment with the particular company, and for that company's work. The Department may also recognize the professional standing of an engineer registered as such in the province in which he is practising and may grant approval as a Design Approval Representative. Departmental approval, however, does not imply automatic qualification of membership in any recognized body of professional engineers. It is only the recognition of certain qualities which would enable the engineer to act on behalf of the Department for the approval of designs, modifications and repairs, as outlined in Para. 2.1.5 or 2.5.2 as applicable.

1.2 AIRCRAFT MAINTENANCE ENGINEER (A.M.E.)

1.2.1 An aircraft maintenance engineer is the holder of a valid A.M.E. licence issued under the Air Regulations, which authorizes him to exercise the applicable privileges as set out in ANO Series IV, No. 6.

1.3 REGIONAL AIRWORTHINESS PERSONNEL

1.3.1 Regional Superintendent, Airworthiness

The Regional Superintendent Airworthiness is the representative of the Director, Airworthiness in all matters concerning the control of airworthiness engineering and inspection in the region.

1.3.2 Regional Airworthiness Engineer

The Regional Airworthiness Engineer is responsible to the Regional Superintendent, Airworthiness for all engineering matters.

1.3.3 Deleted

1.5 SERVICE REPRESENTATIVE

1.5.1 A service representative is a company employee who is approved by the Minister to certify on behalf of the company work done in the field on the product of the company.

1.5.2 He is permitted to actually service the item and is authorized to certify the item as airworthy after the completion of such work.

1.5.3 He is not permitted to certify as airworthy any work related to the product that may be done on the aircraft itself, or on any other aeronautical product in which the company item is embodied.

1.5.4 Service representatives will not be approved for those companies mentioned in Section 1.6.

1.6 APPROVED COMPANIES

1.6.1 An approved company is a firm engaged in the manufacture, conversion, overhaul, repair or maintenance and servicing of aeronautical products, which has undertaken to assume full responsibility for the airworthiness of its product or work by virtue of the certifications given by the members of a company organization and system for quality control set up and maintained to the satisfaction of the Chief Aeronautical Engineer. The persons signing for the company will be authorized to do so by the company, not by the Department, although the Department will not accept anyone not suitably qualified.

1.6.2 The name and address of such companies, together with a summary of the nature of the product, or the scope of the work undertaken, are available for reference at the Regional Offices. Approval remains valid only if the Regional Airworthiness Inspector is advised promptly of any changes in the staff who are authorized by the company to sign inspection certificates.

1.12 MODIFICATIONS

1.12.1 A modification to an aeronautical product is a subordinate change which may affect its airworthiness, but does not alter its basic function or classification. Such changes may involve alterations to the basic structure of an aircraft or its components, changes or additions to systems, equipment or parts embodied therein, intended to provide new or improved services, or changes in the design, construction, or accessory parts of other aeronautical products, such as, engines, propellers, heaters, seats, undercarriage components, etc.

1.12.2 A major modification is an alteration which appreciably affects one or more properties of an aeronautical product which must conform to approved airworthiness standards; after alteration, it must be recertified by a competent authority as meeting the appropriate standards in its new form.

1.12.3 A minor modification is one which does not change any of the properties of the product, or of any aeronautical equipment in which it may be embodied, which must meet airworthiness standards.

Certification of Modifications

5.5.6 All equipment installations or system alterations shall comply with the requirements of Part II, Chapter I, Section 1.9 of this Manual regarding design standards and electrical loading. Weight and balance data and equipment list amendments shall be submitted in respect of all installations in accordance with Section 5.2 of this Chapter. Modifications shall be documented and certified as follows:

Major Modifications

(a) shall be documented as specified in Part II, Chapter I, Section 1.9 and certified in accordance with Part I, Chapter II, Section 2.5;

Minor Modifications

(b) shall be certified in accordance with Part I, Chapter II, Section 2.2.

CHAPTER VI

6.1 AIRWORTHINESS DIRECTIVES

6.1.1 From time to time service experience brings to light certain structural and functional difficulties which may affect the airworthiness of a particular make or model of aircraft. When sufficient justification exists, the airworthiness authority responsible will issue instructions specifying the corrective action which must be taken in order to preserve the airworthiness of the aircraft. Such instructions take the form of Airworthiness Directives, which specify the modification, replacements or special inspections required and the compliance dates or service periods by which the prescribed action must be accomplished. Airworthiness Directives are mandatory, and an aircraft which is not modified or inspected as required by the applicable Airworthiness Directive is considered unairworthy.

NOTE: The term "aircraft" includes the engines, propellers and other items of installed equipment.

The term "Airworthiness Directive" includes equivalent notices issued by the foreign airworthiness authority of the country of origin of the aircraft.

6.1.2 The owner of an aircraft is responsible for compliance with all Airworthiness Directives which apply to his aircraft. The Department will transmit to the owner of a Canadian registered aircraft all applicable Canadian Airworthiness Directives as soon as they are issued or as soon thereafter as practicable and, in addition, will give notice when U.S. directives are issued, but will not undertake to distribute other than Canadian Directives. They will be sent to the latest address of the owner recorded in the Department's files.

6.1.3 Airworthiness Directives frequently refer to Manufacturers' Service Bulletins, or equivalent, for details of the action required. The owner should see to it that he is on the manufacturer's mailing list so that he will receive all relevant Service Bulletins or equivalent information when issued.

6.1.4 [redacted] or special inspection differing from that prescribed by an Airworthiness Directive may be substituted if it provides equivalent safety and is approved by the Department.

6.1.5 Compliance with an Airworthiness Directive shall be recorded in the appropriate section of the aircraft technical log. The log entry shall refer to the Airworthiness Directive by number and also, where applicable, to the corresponding Service Bulletins or equivalent.

6.1.6 Owners should notify the Department of any special circumstances which make it unusually difficult or impracticable to comply with an Airworthiness Directive.

6.1.7 All Airworthiness Directives issued by the United States Federal Aviation Administration in respect of aircraft manufactured in the United States and all equivalent notices issued by the Air Registration Board of Great Britain in respect of aircraft manufactured in the United Kingdom shall apply automatically to such aircraft registered in Canada, unless otherwise notified by the Department. Similarly, all Airworthiness Directives issued by the Federal Aviation Administration in respect of engines, propellers and other equipment manufactured in the United States and all equivalent notices issued by the Air Registration Board in respect of engines, propellers and other equipment manufactured in the United Kingdom shall apply automatically to such equipment used in Canadian registered aircraft, unless otherwise notified by the Department.

6.1.8 The Department will issue an Airworthiness Directive whenever a modification, replacement or special inspection is considered necessary for the continuing airworthiness of:

(a) an aircraft, engine, propeller or other item of equipment manufactured in Canada;

(b) an imported aircraft when no equivalent Airworthiness Directive is issued by the appropriate foreign airworthiness authority, or when it is desired to waive or modify the Airworthiness Directive issued by that authority.

6.1.9 Current Airworthiness Directives issued by the Department are listed in Part III of the Manual.

Amended by A.L. 20

2.5 MAJOR MODIFICATIONS AND MAJOR REPAIRS TO REGISTERED AIRCRAFT

2.5.1 Pursuant to Air Regulations Section 215, certificates of airworthiness shall not remain in force during periods of major modifications or major repairs. Attention is directed also to Air Regulations Section 220 which requires either the owner or pilot of a registered aircraft to notify the Department of any damage requiring repairs other than ordinary running repairs or replacements and to give particulars of such damage.

The following are the requirements respecting the certification of repairs and modifications to registered aircraft.

Certification by Aircraft Maintenance Engineer or Authorized Representative of an Approved Company

2.5.2 Any repairs or modifications which affect either the structural strength or performance or safety qualities of a registered aircraft must not be certified as airworthy unless the work involved complies with one of the following:

(a) A method described in a manufacturer's repair manual;

(b) A method described in authoritative manuals, such as the U.S. Federal Aviation Administration Advisory Circulars 43.13-1A and 43.13-2A, or the British C.A.A. Civil Aircraft Inspection Procedures;

(c) Instructions contained in a manufacturer's service bulletin;

2.5.2 Cont'd

(d) Drawings or method issued and approved by a Design Approval Representative normally employed by a bona fide aircraft manufacturer, repair or overhaul organization; (Copies of all such drawings, calculations, tests and reports must be subsequently submitted to the Department for confirmation, together with a certificate signed by the D.A.R. This certificate is to guarantee the accuracy of any calculations and/or results of tests submitted with the drawings, and certify compliance with specified airworthiness standards. Undue delay in submission of this certificate will be cause for cancellation of the approval.)

(e) Drawings or method approved by the Department;

(f) Applicable airworthiness directives.

2.5.3 Work done complying with Para. 2.5.2 above must, after completion, be certified by a "B" and/or "D" Category A.M.E. or authorized representative and a copy of completed Form AI-101 forwarded to the regional office. If, however, there is any doubt whether the work is adequately described in the manuals or bulletins, the matter is to be referred to the nearest Regional Airworthiness Inspector for a decision.

2.5.4 Drawings dealing with repairs or modifications to individual registered aircraft and submitted for approval by the Department should be forwarded to the nearest Regional Aeronautical Engineer, or Regional Airworthiness Inspector where there is no Regional Aeronautical Engineer.

Aircraft Log Entries

2.5.5 Full particulars of all work done, detailed references to either any repair manual or service bulletin used, or the drawing numbers of any approved drawings forming the basis for airworthiness certification must be given in the aircraft log by the responsible A.M.E. or authorized representative before completing the certification called for in Part I, Chapter II, Sections 2.2 and 2.4.

Repairs to Damaged Spars

2.5.6 In the case of a repair to a damaged spar, unless made either under the supervision and instructions of a Design Approval Representative, or in accordance with a manufacturer's Service Bulletin, complete information and drawings must be submitted to the Department for final approval even if the method adopted follows that recommended in an accepted repair manual, and no airworthiness certification may be made by the responsible Aircraft Maintenance Engineer until final approval of the drawings has been given.

Incorporation of Modifications Similar to Ones Previously Approved

2.5.7 It sometimes happens that modifications similar to ones already designed and incorporated by another organization are to be installed. In such cases there is no need to prepare new drawings or calculations, or submit tests provided the original designer will provide a copy of his drawings covering the modification or change. In such instances when drawings are provided, a certification should be included stating that such drawings are copies of the originals which have been previously approved by the Department.

2.2 AIRCRAFT CERTIFICATION REQUIREMENTS FOR OBTAINING AND KEEPING IN FORCE A CERTIFICATE OF AIRWORTHINESS

Purpose

2.2.1 Pursuant to ANO Series II, No. 4, Certificate of Airworthiness Order, this Section outlines the certification requirements and procedures that shall be followed to obtain and keep in force a Certificate of Airworthiness issued in respect of an aircraft.

Obtaining a Certificate of Airworthiness

2.2.2 Prior to making application for a Certificate of Airworthiness in respect of an aircraft, an applicant shall establish that:

(a) there is issued in respect of the aircraft type:

(i) a DOT Aircraft Type Approval; or

(ii) a FAA Aircraft Type Certificate recognized by the Department;

(b) any modification(s) to the aircraft have been approved or recognized by the Department;

(c) the following applicable certification requirements stated in this Manual have been met in respect of:

(i) a new aircraft manufactured in Canada in accordance with Part I, Chapter III, Section 3.1 of this Manual;

(ii) an aircraft being imported into Canada with a Certificate of Airworthiness for Export in accordance with Part I, Chapter II, Section 2.10 of this Manual; or

(iii) an aircraft being imported into Canada without a Certificate of Airworthiness for Export in accordance with Part I, Chapter II, Section 2.9 of this Manual;

(d) the aircraft conforms to the applicable design approvals referenced in (a) and (b), and is in a fit and safe condition for flight.

2.2.3 Subject to compliance with Para 2.2.2, an applicant shall complete Form 26-0024 as per instructions contained therein and submit it to the applicable Regional or District Office together with all other required documentation as stated in this Manual.

Keeping a Certificate of Airworthiness in Force

2.2.4 After a Certificate of Airworthiness has been issued and as long as the aircraft is operated under Canadian registration, it is the responsibility of the owner or operator to maintain it in accordance with all applicable DOT standards and requirements. This includes ensuring that the Certificate of Airworthiness issued in respect of that aircraft is in force in compliance with ANO Series II, No. 4, prior to permitting the aircraft to be flown.

Types of Certification to be Used

2.2.5 To provide documentary evidence that a Certificate of Airworthiness is in force after maintenance has been completed on an aircraft, an "Airworthy Certification" or "Aircraft Release", depending upon the type of maintenance performed, shall be made in the Aircraft Journey Log of that aircraft by an authorized person. Companies which maintain and certify their aircraft under the provisions of a DOT approved Continuous Maintenance System may continue to use the certifications and certification procedures contained in their approved Maintenance Control Manual.

Airworthy Certification

2.2.6 The Airworthy Certification is the primary means for attesting that scheduled maintenance and certain types of major work have been performed on an aircraft in accordance with applicable DOT maintenance standards and requirements. It is also a declaration that as a result of that maintenance being performed, the continuing airworthiness of the aircraft has been preserved.

2.2.7 An airworthy Certification shall be made in respect of an aircraft after the completion of:

(a) scheduled maintenance checks, including the final segment of each progressive check, when such a system is used, except as provided in Para. 2.2.13(c). In the case of a computerized maintenance program, wherein there are no definitive scheduled maintenance checks, an airworthy certification shall be made at the times that would apply if the aircraft was maintained in accordance with the manufacturer's recommended maintenance program performed at regular intervals as determined by hours in service or calendar time;

(b) repairs, modifications, applicable Airworthiness Directives and equivalent notices that require an inspection of the aircraft as a whole to determine that it is airworthy after the completion of the work;

(c) overhaul of aircraft; and

(d) the Condition and Conformity Inspection (CCI) procedure as set out in Part I, Chapter II, Section 2.3 of this Manual.

2.2.8 An aircraft shall not be certified airworthy unless it has been verified that:

(a) the aircraft owner or his authorized representative confirms that the Certificate of Airworthiness issued in respect of the aircraft has not been cancelled or suspended by the Department under the provisions of Section 213 of the Air Regulations, or that the Certificate of Airworthiness has not expired as a result of the Condition and Conformity Inspection procedure not being accomplished within the time specified in subsection 4(1) of Air Navigation Order, Series II, No. 4;

(b) the weight and balance report is valid in accordance with Part I, Chapter V, Section 5.2 of this Manual;

2.2.8 Cont'd

(c) the maintenance stated in Para. 2.2.7, including minor repairs and minor modifications, was accomplished in accordance with maintenance schedules, instructions, methods and procedures established for that aircraft in compliance with Part I, Chapter II, Section 2.12 of this Manual;

(d) any dual inspection required was certified in accordance with Part II, Chapter II, Section 2.1 of this Manual;

(e) any major modification or major repair was certified by authorized personnel in accordance with the requirements and procedures stated in Part I, Chapter II, Section 2.5, and if applicable, Part I, Chapter V, Section 5.5 of this Manual;

(f) special requirements for agricultural aircraft operated in an overweight condition were followed in accordance with Part II, Chapter II, Section 2.3 of this Manual;

(g) all applicable Airworthiness Directives and equivalent notices have been accomplished (See Part II, Chapter VI, Section 6.1); and

(h) details of the maintenance accomplished have been certified in compliance with Air Navigation Order, Series VIII, No. 2, Aircraft Journey Log Order.

Persons Authorized to Certify Aircraft Airworthy

2.2.9 Pursuant to Air Navigation Order, Series II, No. 4, the following persons are authorized to certify an aircraft airworthy:

(a) the holder of a valid Aircraft Maintenance Engineer Licence endorsed in Category "A" or "R", whichever is applicable, for the type of aircraft being certified;

(b) an authorized representative of an approved company that has been granted authority under the provisions of this Manual to make the certification; and

(c) any person authorized under the provisions of Part I, Chapter II, Section 2.15 of this Manual, in respect of an aircraft operating outside of Canada.

Airworthy Certification Statement

2.2.10 Except as stated in Para. 2.2.11, the following certification statement shall be entered in the aircraft journey log by a person authorized to certify an aircraft airworthy:

"I certify that all applicable requirements stated in the Engineering and Inspection Manual have been met and the aircraft is determined to be airworthy."

(a) "Signature of AME .....
Licence No. .....Date ......"; or

(b) "Signature of Authorized Representative of
Approved Company .....
Company No. .....Date ....."; or

(c) "Signature of person granted authority to
certify under sub-para 2.2.9(c) .....".
.....Date .....

2.2.11 Certification statements in use prior to the effective date of this Section may continue to be used in place of Para. 2.2.10 until 1 January 1980, after which time the use of the certification statement referred to in Para. 2.2.10 shall be mandatory.

Aircraft Release

2.2.12 The Aircraft Release provides a certification, attesting that maintenance work other than which requires an airworthy certification, has been performed in accordance with all applicable DOT standards and procedures. This will permit the aircraft to be returned to service without the need to perform an inspection of the aircraft as a whole in order to determine it is airworthy.

2.2.13 An Aircraft Release may be made in respect of an aircraft in lieu of an Airworthy Certification, upon completion of the following maintenance:

(a) repairs and modifications which do not require an inspection of the aircraft as a whole, in order to determine that it is airworthy, after completion of the work;

2.2.13 Cont'd

(b) Airworthiness Directives and equivalent notices, providing any repair or modification involved does not exceed the provisions of (a);

(c) on private registered aircraft, routine minor maintenance work performed between scheduled inpsections, and minor scheduled maintenance checks performed in accordance with Part I, Chapter II, Section 2.17 of this manual;

(d) routine maintenance work performed between scheduled inspections, on commercial registered aircraft, provided that the aircraft is released in accordance with the procedures contained in the approved Maintenance Control Manual; and

(e) each segment of a progressive maintenance check except for the final segment at which time the aircraft shall be certified airworthy. In the case of a computerized maintenance program, wherein there are no definitive scheduled maintenance checks, the aircraft shall be released after any maintenance has been performed in accordance with the program except when the aircraft is required to be certified airworthy in accordance with sub-para 2.2.7(a).

2.2.14 An aircraft release shall not be made unless it has been verified that:

(a) the maintenance stated in Para. 2.2.13, including minor repairs and minor modifications, was accomplished in accordance with maintenance schedules, instructions, methods and procedures established for that aircraft in compliance with Part I, Chapter II, Section 2.12 of this Manual;

(b) any dual inspection required was certified in accordance with Part II, Chapter II, Section 2.1 of this Manual;

(c) any major modification or major repair was certified by authorized personnel in accordance with the requirements and procedures stated in Part I, Chapter II, Section 2.5, or if applicable, avionics work referenced in Part I, Section 5.5 of this Manual;

2.2.14 Cont'd

(d) in the event of a modification being incorporated which changes the empty weight of the aircraft, the weight and balance report has been amended in accordance with Part I, Chapter V, Section 5.2 of this Manual;

(e) special requirements for agricultural aircraft operated in an overweight condition were followed in accordance with Part II, Chapter II, Section 2.3 of this Manual; and

(f) details of the maintenance accomplished have been certified in compliance with Air Navigation Order, Series VIII, No. 2, Aircraft Journey Log Order.

Persons Authorized to Make an Aircraft Release

2.2.15 Pursuant to Air Navigation Order, Series II, No. 4, the following persons are authorized to make an Aircraft Release:

(a) the holder of a valid Aircraft Maintenance Engineer Licence endorsed in Category "A" or "R", whichever is applicable, for the type of aircraft being released;

(b) an authorized representative of an approved company that has been granted authority under the provisions of this Manual to release the aircraft;

(c) any persons authorized under the provisions of Part I, Chapter II, Section 2.15 of this Manual in respect of aircraft operating outside of Canada;

(d) any persons authorized under the provisions of Part I, Chapter II, Section 2.17 of this Manual; and

(e) any persons authorized in an Airworthiness Directive or equivalent notice to perform the work detailed in the Directive or notice, e.g. the aircraft owner or pilot.

Aircraft Release Statement

2.2.16 The following entry shall be used by an authorized person for making an Aircraft Release:

"I certify that all applicable airworthiness requirements stated in the Engineering and Inspection Manual have been met in respect of the work done and the aircraft is released for return to service.

(a) "Signature of AME .....
Licence No. ..... Date ......"; or

(b) "Signature of Authorized Representative of
Approved Company .....
Company No. ..... Date ....."; or

(c) "Signature of other person permitted to release an aircraft under para 2.2.15 .....
..... Date .....

TABLE I

WHEN ENTRIES REQUIRED	FORMS	LOG BOOK ENTRIES	AUTHORIZED SIGNATORY
(a) Upon Application for Certificate of Airworthiness for:			
1) New Aircraft Manufactured in Canada	A.I.-100 26-0024	1 5 9	AME-B AME-A or B Pilot
2) New Aircraft Imported with C of A for Export	26-0024	9	AME-A or B Pilot
3) Used Aircraft Imported with C of A for Export	26-0024	9	AME-A or B Pilot
4) Used Aircraft Imported Without C of A for Export	A.I.-101 (if req'd) 26-0024	2 (if req'd) 9	AME-B AME-A or B Pilot
5) Aircraft With an Expired C of A	26-0024	3 9	AME-A or B Pilot

Amended by A.I.24

TABLE I Cont'd

(D) Operation under Authority of a Flight Permit:			
1) Upon Application for a Flight Permit	26-0024	7 9	AME-A or R Pilot (owner ultra-light only)
2) Upon Initial Application for Ultra-Light Aircraft	26-0129	7	Owner
3) Ferry Flight	Upon Request	7	AME-A or R, and AME-B, if applicable
4) Following Maintenance Activities		7	AME-A or R, and AME-B, if applicable

Amended by A.L. 20

TABLE I Cont'd

(c) Following Maintenance Activities:			
1) Aircraft operating under a CM System		8	Authorized Company Inspectors
2) After overhaul, major repair or major modification	A.I.-101	2 5 9	AME-B AME-A or R Pilot
3) After minor repair or minor modification		12	AME-A or R
4) After Dual Inspection of Flight and Powerplant Controls		11	AME-A or R or Pilot
5) Reciprocal Certification of U.S. Registered aircraft while in Canada		See FAR 43	AME-A or R, and AME-B if applicable
6) After servicing of a privately registered aircraft by other than an AME		10	Person performing work

TABLE I Cont'd

(d) Recurring Certifications			
1) Condition and Conformity Inspection (CCI) procedure	24-0006	3 9	AME-A or R Pilot
2) Agricultural aircraft being operated in an overweight condition.		5	AME-A or R or Pilot
3) On completion of Periodic Inspection		4	AME-A or R
4) Periodic Certification of Aircraft (ANO Series II, No. 4)		6	AME-A or R

NOTE 1: Where AME is mentioned it is implied that the certification may also be done by an Authorized Representative of a Company approved by the Department of Transport.

NOTE 2: Reference Table I, Section (a)(4). Certification No. 4 is required whenever the aircraft is not released with an A.I.-101 and certification No. 5 whenever the aircraft is released with an A.I.-101.